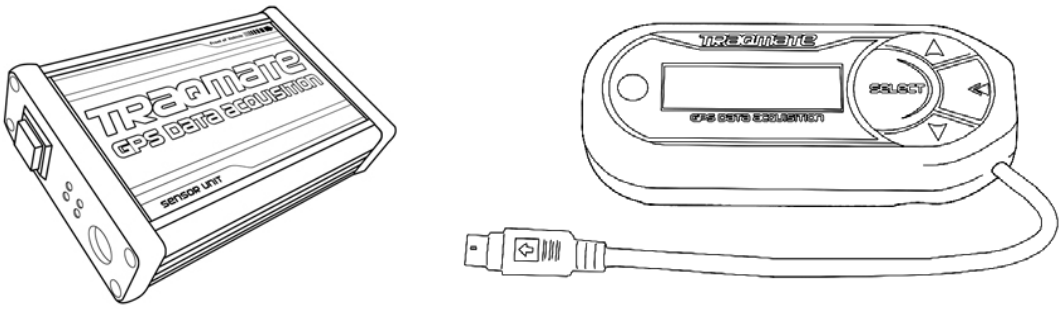
TRAQMATE

GPS DATA ACQUISITION SYSTEM



USER MANUAL

VERSION 2.15 DECEMBER 4, 2008

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Table of Contents

WELCOME TO TEAM TRAQMATE 6

SYSTEM OVERVIEW 7

TRAQMATE FEATURES 7
TRAQMATE SYSTEM COMPONENTS 8
Sensor Unit 8
Display Unit 8
Traqview 9
TRAQMATE SYSTEM PACKAGES 10
Traqmate Basic 10
Traqmate Complete 10
Accessories 10

QUICK GUIDE – LET'S COLLECT SOME DATA 11

TRAQVIEW / TRAQSTUDIO SOFTWARE INSTALLATION 12

TRAQVIEW / TRAQSTUDIO ANALYSIS SOFTWARE 12
USB DRIVER 12

TRAQMATE INSTALLATION 13

SENSOR UNIT INSTALLATION 13
Traqmate Basic Installation 14
Traqmate Complete Installation 14
GPS ANTENNA PLACEMENT AND INSTALLATION 14
CONNECTING A SENSOR UNIT TO A DISPLAY UNIT 14
POWER CONNECTION 15
Cigarette Lighter Adapter 15
TraqPaq Rechargeable Li-ion Battery Pack 15
Permanent Wiring Harness Installation 15
TraqAC Power Supply 16
TRAQMATE DISPLAY UNIT INSTALLATION 16
Mounting 16
Connecting to the Sensor Unit 17

TRAQMATE BASIC 18

SYSTEM DESCRIPTION 18
CONTROLS 18
PWR / REC – Power Switch Button 18
LED Light Displays 18
COM – Communications Port 18
PWR – Power Port 18
GPS – GPS Antenna Port 18
AUX – Auxiliary Port 18

TRAQMATE COMPLETE 19

SYSTEM DESCRIPTION 19
CONTROLS 19
ON/OFF – Power Switch Button 19
Traqmate Logo – Backlight Button 19
Select Button – Executes Menu Functions 19
Back Button – Exits Menu Functions 19
Up Button 19
Down Button 19
MENU SYSTEM 20
DISPLAY UNIT ICONS 22
FEATURES 22
Lap Timing 22
Autocross / Rally Mode 25
Segment Timing Mode 26
Using for Closed Circuit Feedback 26

TRAQVIEW / TRAQSTUDIO ANALYSIS AND CONFIGURATION PROGRAM 27

TRAQVIEW SCREEN LAYOUT 27
TOOLBAR BUTTONS AND CONTROLS 27
MENU OPTIONS 28

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GENERAL TRAQVIEW OPTIONS 29
FILES 30
Opening Files *30*
Saving Files *30*
Adding Drivers *30*
Exporting Graph Images and Segment Analysis Table *30*
Exporting Data Files *30*
VIEWING OPTIONS 31
EXCHANGING INFORMATION WITH TRAQMATE 32
Connecting to Traqmate *32*
UNIT INFO SCREEN 33
SU Basic Settings – These appear only when connected to a Traqmate Basic Unit. *33*
User Data Screen *34*
IO Data Screen *35*
Session Upload Screen *37*
ANALYSIS TOOLS 37
Dashboard *37*
Setup Screen *38*
Changing Vehicle Name and Adding Notes *40*
Playback Controls *40*
Track Map *41*
Track Facts *42*
Car Facts *42*
G vs. Time *43*
G vs. Distance *43*
Velocity vs. Time *43*
Velocity vs. Distance *43*
Time Gap vs. Distance *44*
Horsepower and Torque *44*
Elevation *45*
Track Turn Radius *46*
Friction Circle *47*
Braking and Acceleration Zones *48*
Turn Zones *49*
Segment Analysis *50*
Separate Start / Finish (Rally) Mode *52*
Traqview Updates *58*
Traqmate SU and DU Firmware Updates *58*
TRAQSTUDIO DATA/VIDEO INTEGRATION 59
VIDEO INTEGRATION 59
TraqCam Instructions *60*
Manual Synchronization *60*
WRITING VIDEOS 61
Input Options *62*
Output Options *62*
Screen Features *63*
Creating a CD *63*
Creating a DVD *63*
TRAQTACH / TRAQDATA INSTALLATION AND SETUP 64
HOOKING UP A TACH INPUT (TRAQDATA, TRAQTACH, TRAQSYNC) 64
Changing Voltage Range of TraqTach, TraqSync, and TraqData II *64*
Selecting the Tach Signal *64*
Terminating Wire at Input Device *65*
HOOKING UP DATA INPUTS AND OUTPUTS 66
DigitalS *66*
Analogs *67*
HOOKING UP A CHASECAM PDR100 (TRAQCAM SETUP) 70
ChaseCam PDR100 Digital Video Recorder Operation *72*
ChaseCam SS1000 Split-Screen Processor Operation *73*
USING TRAQMATE FOR ANALYSIS 74
DRIVER COMPARISON 74
Best Lap Playback *74*

Best vs. Worst Playback *74*
Velocity vs. Distance *74*
Driving Line *75*
Segments *75*
G vs. Distance Analysis *76*
Friction Circle *77*
Graphing Multiple Data Elements (Stacked Graphs) *78*
VEHICLE PERFORMANCE COMPARISON 79
Acceleration and Braking *79*
Lateral Gs *80*
SAFETY 81
SHARE & COMPARE – TRAQMATE.COM 83
EXCHANGING LAPS 83
APPENDICES 84
TABLE OF FIGURES 84
Traqmate Complete *86*
Traqmate Basic *86*
TraqStudio *86*
WARRANTY INFORMATION 86
GLOSSARY 87
ABOUT GPS DATA ACQUISITION 88
GPS Frequently Asked Questions *89*

Welcome to Team Traqmate

Thank you for purchasing the Traqmate System, the powerful but easy-to-use Data Acquisition System. You will be amazed at the depth of information available without modifying your vehicle or learning to decipher complicated data tables.

Traqmate was designed by racers and is great for getting the first or last second out of your lap times. It is also great for the track day enthusiast who wants to record their day, play it back with their video, analyze their performance to get the most out of their car, and do a little bench racing with their friends.

With the addition of this small device to your track bag, you will be able to better tune car and driver for maximum performance. While it is very easy to learn, please take a moment to read this manual so you can discover all the capabilities and get the most out your Traqmate.

As a Traqmate owner, you really are a member of Team Traqmate. Use the traqmate.com website to 'Share and Compare', trading laps with thousands of other Traqmate enthusiasts around the world.

We at Track Systems are continually improving Traqmate and Traqview by adding additional innovative features that are available to download so make sure you check traqmate.com frequently for the latest software.

The 2.00 release level was created with input from our thousands of customers. Suggestions such as predictive lap timing, theoretical best lap calculations, automatic segments, time differential graph, graph filtering, and even video integration were all based on direct feedback from our customers.

We have continued that with the 2.10 and 2.15 releases. We have added video writing capability with the new TraqStudio program, made data and video synchronization even easier with the TraqSync ChaseCam 4-wire Interface Module, and kicked predictive lap timing up a notch by storing the sector information between sessions. Traqview can now calculate the gear you are using, horsepower and torque, and the graphs are improved. We also added car and driver notes so you can record information about your session for use later. And Traqview and TraqStudio are now Vista-64 bit compatible.

We added a new mode to Traqmate Complete called Segment Timing that can be used for rolling-start timing or detailed sector analysis on the track. Traqmate Basic can now start and stop itself so you never miss a session. And, as usual, there are many hidden improvements to make the unit work even better. Thanks for helping us keep Traqmate on the cutting edge.

See you at the track,

Glenn Stephens
President
Track Systems Technologies, LLC

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System Overview

The Traqmate is a vehicle data acquisition device that uses a high-speed GPS receiver and high-resolution accelerometers to track and record the speed of a vehicle, its absolute location, and forces acting on the vehicle.

The Track Systems Traqview analysis program uses advanced mathematical algorithms to translate this data into visual form where it is easy to spot differences between drivers, vehicles, and sessions.

Traqmate Features

Drop and Go – Stick a Traqmate in your car, turn it on, and collect data all day long. No sensors required.

Replay Your Day – Upload the data into Traqview. See your car on the track and your performance on the virtual dashboard.

Instant Gratification – See your lap times as they happen on the in-car display.

Share and Compare – Create virtual races with friends or with yourself from different sessions. Trade laps with your friends. Learn from them.

Easy to Use – No engineering degree required. The Traqmate Basic Unit has one button. What could be easier? The Traqmate Complete Display Unit is menu-driven with prompts in English. Just pick what you want – no typing, no memorizing buttons.

Analyze – Zoom in on your lap. Single step to see G loads and speed. Compare braking and acceleration points between cars and drivers. Graph data vs. time and distance.

Share Your Toys – Loan your Traqmate to a friend or loan your car to a faster driver. Then compare their laps against your own. Even two drivers with equal laptimes can both learn from one another.

Rugged – Traqmate was designed to withstand the tough environment of a race car to give you years of service.

Grow – Want even more information? Add sensors for digital, analog, and tachometer inputs.

It Gets Better – Traqmate's heart is a very powerful microprocessor so new features and functionality will be made available over time. Download new software from traqmate.com, reprogram the unit, and you are good to go.

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Traqmate System Components

The Traqmate System has three main components – the Sensor Unit (SU) contains the sensitive electronics to measure location and G-forces. The Display Unit (DU) contains a graphical display for viewing laptimes as they happen. The final component is Traqview, the innovative Windows software that allows you to view your performance in many different ways.

Sensor Unit

In addition to the GPS receiver to measure position and the accelerometers to measure forces, the Sensor Unit has digital, analog, and frequency inputs for measuring individual aspects of vehicle performance such as RPM or steering wheel position. These are recorded alongside the position and force data for easy graphing.

Four LEDs indicate power, data collection mode, GPS signal, and data communications activity. The Sensor Unit can be used standalone or in conjunction with a Display Unit, in which case it is entirely remotely controlled. When used alone (Traqmate Basic), the Sensor Unit has a single red button on the front panel for ON/OFF and for entering and exiting data recording mode.

The Sensor Unit can be customized using the Traqview Analysis Program. You can enter Drivers, Tracks, and Vehicles and all data is date and time-stamped so there is never any confusion. In addition, Traqview lets you customize the unit with your name and contact information in case it is lost or stolen.

Display Unit

The Display Unit (DU) is a major leap in low-cost data acquisition providing in-car lap timing without a need for external beacons. The graphical and menu-driven user interface makes data collection easy and fun. Even more innovative, the DU is a USB-powered data storage device. Unclip it from your car and plug it into your PC's USB port. The Display Unit powers up and transfers your data right into Traqview where your sessions are listed by Driver, Track, and Vehicle.

The DU has a backlit bitmapped screen for easy reading day or night. The membrane switch has large buttons so it can be accessed with gloves and is resistant to moisture, dirt, and grease. Mount it anywhere with Velcro or the accessory quick clip.

With the Traqmate DU, in-car lap timing has never been easier. For each track, press the SELECT button at the start/finish line to permanently store that information in the DU. The unit will remember that track in the future. Place the unit in Lapping Mode and watch your laps click off. The display shows Lap Number, Lap Time, Best Lap, and whether the lap was faster or slower that the previous lap. Lap Timing continues even if GPS signal is lost or spotty. Review laps for any session and delete the ones you don't want.

The Display Unit is attractive enough to use every day. When traveling to the track, turn on the DU and you will get a nice GPS compass, atomic clock, and a speedometer.

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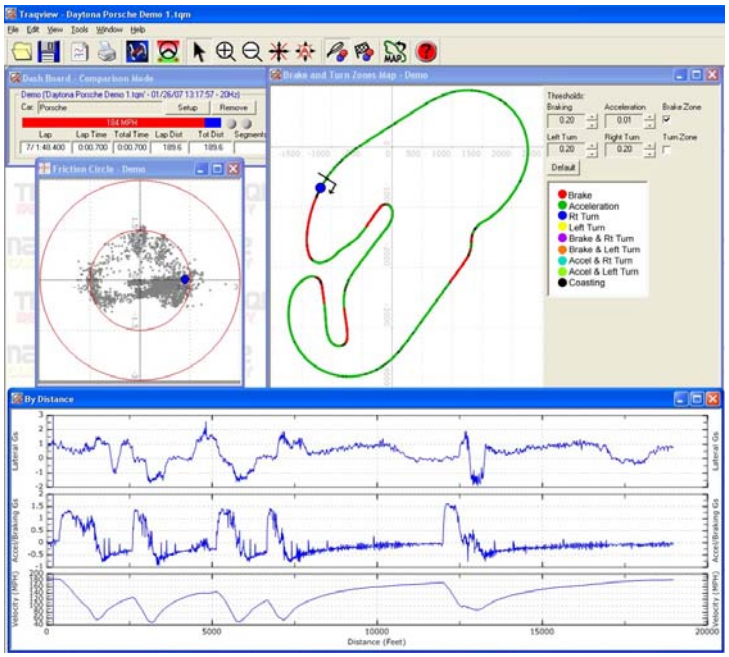
Traqview



A data acquisition system is only as good as the analysis program. Traqview is a new approach that merges hard-core data analysis with the fun of a video game. The track mapping is accurate and gives an instant read on what is happening where. Multi-car playback lets you see graphically who is faster where.

Record several cars in a race and replay the entire race in real-time, slow-mo, or fast forward. See their speed, G loads, braking and acceleration for every car on the virtual dashboard.

Traqview has all the tools you need to optimize the performance of both car and driver. For example, you can display graphs like Velocity vs. Distance to see who is faster in which corners and then define a sector on the map and zoom in to see braking points, instantaneous velocities, acceleration points, and transfer speeds through a corner.

For an added dimension, the optional TraqStudio allows simultaneous synchronized playback of data and video.

Traqview is your single point of contact for everything in the Traqmate System. Use it to upload data from Traqmate, analyze the data, configure Tracks, Drivers, Vehicles and optional Sensors, change the Sampling Rate, and even download future software and feature upgrades into your Traqmate.

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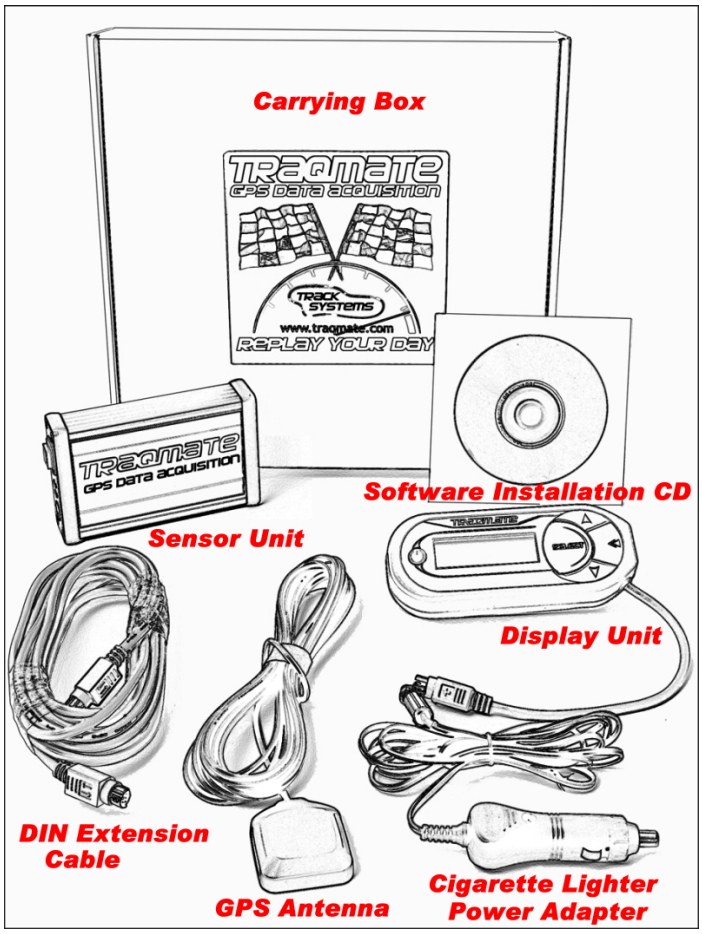
Traqmate System Packages



This diagram will help you identify the Traqmate Components. Traqmate comes as two bundled packages. Each includes everything you need to collect and analyze your data.

Traqmate Basic

The Traqmate Basic package consists of a Sensor Unit (SU), GPS antenna, serial cable, power cable, carrying box, and compact data disc containing the Traqview Analysis software and manual.

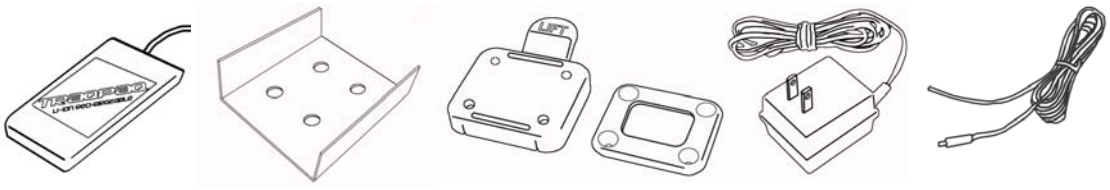
Traqmate Complete

The Traqmate Complete package consists of a Sensor Unit (SU), a Display Unit (DU), GPS antenna, USB cable, SU-DU DIN connection cable, power cable, carrying box, and compact data disc containing the Traqview Analysis Software and User Manual.

Figure 1 - Traqmate System Components

Accessories

Accessories include a TraqPaq Li-ion battery pack and charger, optional power connections, Display Unit mounting brackets, TraqData analog/digital/RPM input device, TraqTach RPM input device, Li-ion Rechargeable and AA Alkaline TraqPaq battery packs, ChaseCam video products, extra antennas for convenient vehicle swapping, and the SU mounting tray.



TraqPaq Li-ion Pack | **SU Mounting Tray** | **DU Mounting Bracket** | **TraqAC Power Supply** | **Permanent Power Cable**

Quick Guide – Let's Collect Some Data

You just bought a Traqmate Complete and you want to try it out. This is as simple as it gets.

First, install the software. Put the CD in your drive and follow the directions. For most users it is seamless. If not, refer to the more detailed instructions elsewhere in this manual.

Put the Traqmate on the floor of your car. Plug in the cigarette lighter cable. Plug the DIN extension between the Display Unit (DU) and Sensor Unit (SU). Screw the GPS antenna into the SU and place it on your roof.

Press the leftmost round button on the DU to turn on the unit. The DU should light up and display the startup screen, followed by the menu. Select 'Record Data' and 'Drive'.

The unit will search for GPS and lock on within a minute or so. As you start moving, you should see your direction, the time, and your speed on the display.

Go drive somewhere.

Press the rightmost red button to stop recording.

Turn off the Traqmate with the leftmost button (Press and hold for 3 seconds).

Unplug the DIN cable and take your DU to your PC.

Plug the USB cable between the DU and PC and the DU should start up.

Launch Traqview and select 'Connect to Traqmate'. You should see the session that is stored on the DU listed on the Traqview screen.

Click 'Download Selected Sessions' and your session will be saved on your computer.

Click on the open file folder at the upper left of the screen. You should see the session you just saved. Select it and click 'OK'.

You should now see your route and the dashboard on the screen.

Click on the Play control at the bottom of the screen and 'Replay Your Day'.

With Traqmate, Data Acquisition is just that easy. Enjoy.

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Traqview / TraqStudio Software Installation

NOTE: It is important to install the software and USB driver before plugging the unit into your PC.

Traqview is designed to work with most current Microsoft Windows compatible computers, including Vista systems. Check the Systems Requirements section of this manual to ensure that your system is compatible.

To install the software, insert the compact disc into your PC's compact disc drive. If you do not have a CD reader on your PC, you can download the software and user manual from the Traqmate website at www.traqmate.com. You may also check there for software updates.

Traqview / TraqStudio Analysis Software

Insert the CD and a menu will appear. The CD should automatically run when inserted. If it does not, open "My Computer" and right-click on the CD drive. Choose "Explore". Now double-click TraqSetup.exe to run the installer program. The default options work well for most systems.

If you have a Display Unit you should install "USB Pre-Installer". You may de-select this option if you are installing a Traqview Basic system.

The system will scan for old drivers. This may take some time.

You may get a warning that 'Windows can't verify the publisher of this driver software'. Choose 'Install Anyway'.

If old drivers were replaced, you may be asked to restart the computer. Choose 'Yes'.

When finished the program is placed in the "Program Files/Track Systems folder". You should not have to repeat this installation in the future.

USB Driver

Once the USB drivers are installed, get your Display Unit and the mini-USB cable. Plug the cable into the DU and into a USB port on your computer. The Display Unit should power up and your computer will announce "Found New Hardware".

The New Hardware Wizard will execute for the **Track Systems CP210x USB to USART Bridge**.

Choose to search 'This Time Only' and 'Install Automatically'.

When given a warning, choose to 'Continue Anyway'.

Depending on what drivers and libraries were installed, you may be asked to restart your computer. You will not have to install this driver again in the future.

NOTE: If at any time during the install the system cannot location the USB drivers, you may select Choose a Driver Location and enter:

C:\Program Files\TraqmateUSB

NOTE: When you launch Traqview and attempt to connect to the Traqmate, if the USB port is not automatically recognized you will be prompted for the COM Port number. Choose AutoConnect and the software will find the right port. After the correct port is assigned, it should work automatically in the future.

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Traqmate Installation

These diagrams show the overall connections for the Traqmate Basic and Traqmate Complete Systems.

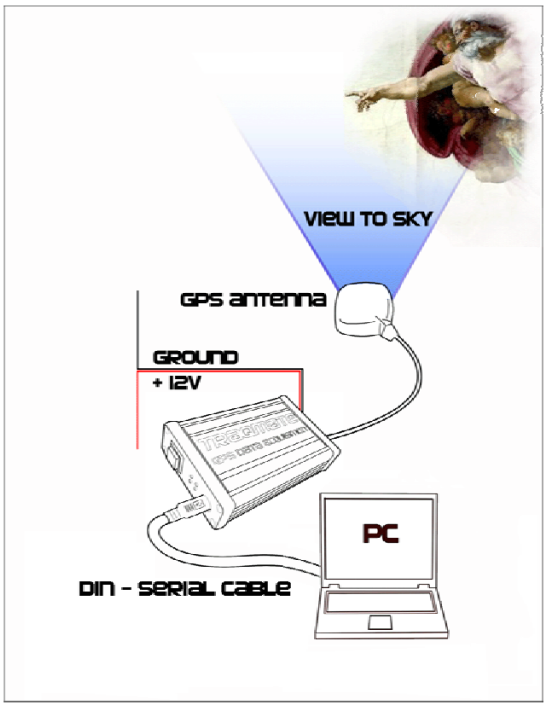


Figure 2 - Traqmate Basic Connections

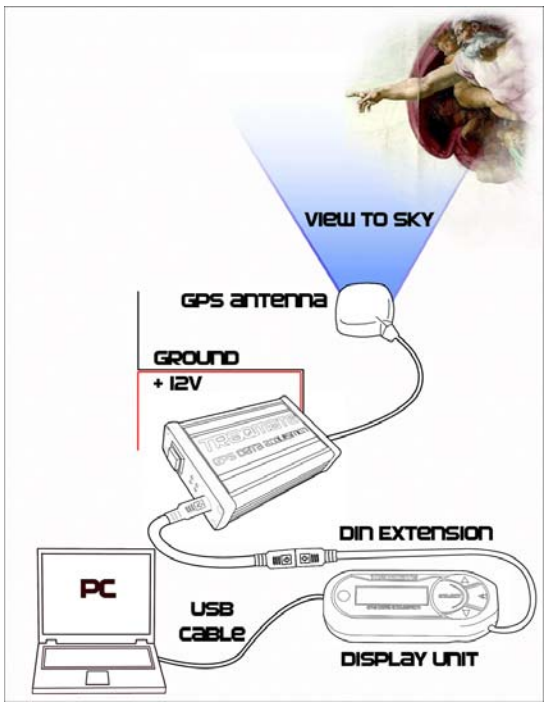
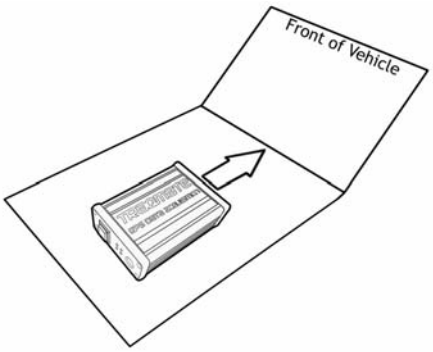


Figure 3 - Traqmate Complete Connections

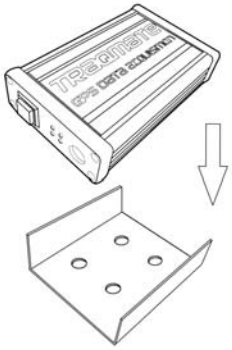
Sensor Unit Installation

The Traqmate sensor unit may be mounted using a variety of methods depending on the following factors: 1) How permanent is the desired mount, 2) where is the preferred mounting point, 3) will the SU be connected to a Display Unit (DU).



CHOOSE A LOCATION WHERE THE UNIT WILL NOT BE SUBJECTED TO WATER. EXCESSIVE MOISTURE EXPOSURE WILL DAMAGE THE UNIT.

The Sensor Unit must be mounted as flat as possible in the vehicle and such that the arrow on the top label points in the direction of travel.



This is to ensure the accelerometers are the most accurate and have the best range for making measurements. It is also a good idea to place the unit as close to the vehicle's center of gravity as possible. While not required, especially with connection to the DU, it may be desirable to mount the SU in a location that allows the indicator lights to be viewed easily by the driver. Given these considerations, a position on the floor of the front passenger footwell may work well. Other good locations include the trunk floor and on the transmission tunnel.

The mounting of the SU may be accomplished in a variety of ways, but the most desirable and secure method is to use the Sensor Unit Mounting Tray (shown here), offered as a separate accessory from Track Systems. The mounting tray can be attached permanently to the vehicle, and by placing Velcro on the SU enclosure, and the mounting tray, the SU is securely fastened, while at the same time being easily removable. Once the mounting tray is aligned in the vehicle, the SU can be easily placed in the mounting tray and the alignment is set.

Another method for mounting the SU is to apply Velcro directly to the SU and the mating piece directly to the vehicle. Care should be taken when placing the SU on the Velcro that it is properly aligned in the vehicle and that the SU is securely attached.

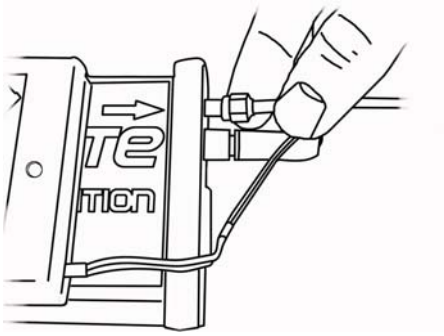
Traqmate Basic Installation

If the SU is going to be used in a configuration without the DU (Traqmate Basic), it is desirable to have access to the SU for downloading the data once it has been stored. Similarly, if a laptop is going to be used to download the stored data without removing the SU, the unit should be placed in a convenient and accessible location. In the case where the SU will be removed to download the data, the mounting should take into account replacing the SU in a secure and aligned manner.

Traqmate Complete Installation

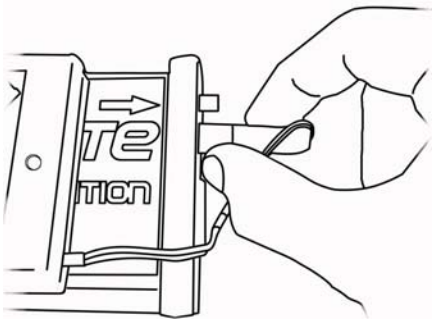
If the SU is going to be connected to a DU, the mounting of the SU is not as critical with respect to operator access. In this configuration, the DU stores the data and is the focal point for downloading to a PC.

GPS Antenna Placement and Installation



The supplied GPS antenna has a magnetic mount, which allows a variety of mounting options to the metal body of the vehicle. In the case where the desired location is not metal, double stick tape is a viable option for mounting the antenna. The placement of the antenna can have a great effect on the performance of the data collection system. Ideally, the antenna should be placed on the highest part of the exterior of the vehicle. Placing the antenna inside the vehicle can cause “blind spots” where the antenna is not able to see as many of the GPS satellites that may be available to it. The system works best when the antenna has the least restricted view of the sky. Once a location has been determined for the antenna placement, the wire connecting the antenna and the SU should be routed in a manner such that it is not placed under stress, and the wire will not be exposed to frequent bending or crimping. After routing the wire to the SU, connect the antenna to the SU by screwing the antenna wire to the GPS connector indicated on the end panel of the SU.

Connecting a Sensor Unit to a Display Unit

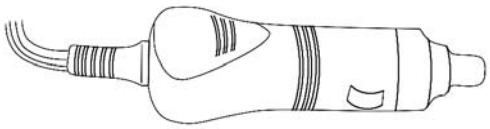


With Traqmate Complete a 6’ or 12’ DIN-to-DIN connection cable is provided. This is a standard male-to-male cable, which allows a great deal of flexibility in the placement of the SU and DU. The cable should be routed to be securely protected from damage during normal vehicle operation.

Power Connection

In all installations, the SU must be supplied with a power source at all times it is in operation. For Traqmate Complete, the DU can receive power via the DIN extension cable from the SU or via the USB cable when connected to a PC for uploading sessions.

The SU was designed to be powered from a +12 VDC battery supply in four different ways; a permanent wiring harness in the vehicle, a cigarette lighter adapter, a battery pack, and a wall charger. Each of these will be discussed separately.



Cigarette Lighter Adapter

For installations where a permanent power supply connection is not required or desired, the cigarette lighter adapter offers a quick and convenient solution. This adapter can be secured to the SU by inserting the plug into the power connector (PWR) on the SU and tightening the threaded nut to the power (PWR) socket. Once the SU and the power connector have been secured, the cigarette lighter adapter can be plugged into one of the cigarette lighter sockets located in the vehicle. It should be noted that many automobiles have cigarette lighter sockets that are always ON and do not turn the power off when the ignition switch has been turned to the OFF position. The cigarette lighter adapter has a RED LED to indicate that vehicle battery power is presented to the adapter. During extended vehicle idle periods, the cigarette lighter adapter should be removed from the vehicle socket to prevent vehicle battery drain.

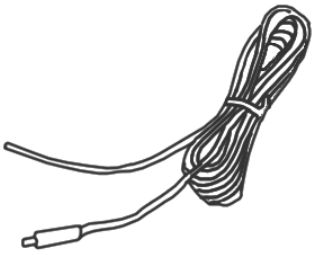
TraqPaq Rechargeable Li-ion Battery Pack

The TraqPaq Rechargeable is very convenient and has the advantage of reusability. The TraqPaq Rechargeable Battery Pack is capable of powering a Traqmate for 7-10 hours on a full charge.

If not handled properly **Li-ion batteries can be dangerous**. Traqmate Li-ion packs have a protection circuit for overcharge and excessive discharge and should provide years of service under normal circumstances. **If the pack ever starts to overheat or swell, discontinue use immediately.**
To recharge the pack, just plug it into the Traqmate Li-ion charger. It will recharge in approximately 2 hours, at which time the LED on the charger will change from red to green.

Only use the Traqmate charger with Traqmate Li-ion Rechargeable battery packs. **Never charge any other types of batteries using the Li-ion charger**. This includes alkaline or NiCd or NiMH batteries in a non-rechargeable TraqPaq.

Permanent Wiring Harness Installation



The power cable is a 13 foot, two conductor, red and black zip cable that has a plug on one end and is not terminated on the other end. The power plug contains a threaded nut for securing the plug to the power jack (PWR) on the Traqmate Sensor Unit (SU). The other end of the cable is intended to connect to either the automobile battery or a junction box. Since the SU mounting location can vary widely (trunk, under seat, floorboard, etc.) the required cable length will also vary. Consequently, the cable can be cut to an appropriate length suitable for your automobile, once the mounting location is selected.

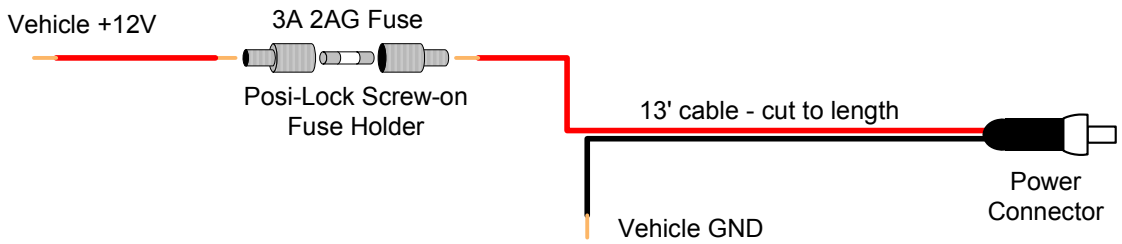


Figure 4 - Permanent Wiring Harness

The red wire is to be connected to the positive (+) side of the battery and the black lead to the negative (-) or chassis side. A fuse holder has also been included with the power cable. The red conductor of the zip power cable should be cut and stripped about ¼ inch on both ends. Each end should be inserted into the Posi-Lock fuse holder and screwed down tight. The bare end of the wire should be inserted / crimped into a crimp lug or other suitable connector (not included). The lug should be connected to the positive (+) battery terminal or a switched positive (+) terminal.

If the SU is connected directly to the positive (+) battery terminal, the SU will continue to be powered when the ignition switch has been turned to the OFF position. Extended vehicle idle periods may drain the vehicle battery if the unit is not turned off using the front panel button. If this is a concern for your installation, efforts should be made to connect the positive (+) terminal to a switched supply.

The black conductor should be stripped and a crimp lug or other suitable connector applied (not included). The lug on the black conductor should then be connected to the negative (-) battery terminal or chassis ground.

TraqAC Power Supply

The TraqAC can be utilized to power the SU during periods in which the SU has been disconnected from the vehicle power and operation is still required. That is, the SU can be powered by the TraqAC during periods in which the SU data is being downloaded to a computer containing the Traqview software.

The TraqAC is attached to the SU by inserting the power plug into the power connector socket (PWR) on the SU. Once the TraqAC has been connected to the SU, it is ready to plug into the 110VAC wall outlet.

Traqmate Display Unit Installation

Mounting

It is important to mount the Display Unit so that it can be easily seen by the driver but does not interfere with the operation of the vehicle. You may use the Velcro strip provided to attach the unit to your gauge cluster or center console as shown below. This is a very flexible approach to mounting the DU and works well for most applications. Care should be taken however, such that the DU does not come loose during the anticipated operation of the vehicle. The DU has been designed with the standard AMPS cellular-phone mounting pattern on the back cover. This allows many cellular and satellite-radio mounting options to be used. These include goosenecks, articulated arms, as well as the Display Unit Mounting Bracket and Suction Cup Window Mount which are sold as accessories. With the Display Unit Mounting Bracket, the DU can be snapped quickly and securely into the mating portion of the bracket, which remains permanently affixed to the vehicle. Care should be taken to avoid strain on the DU cable.

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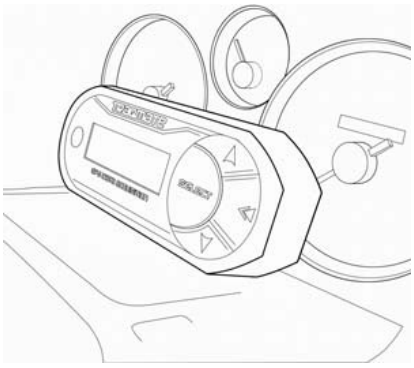


Figure 5 - DU Gauge Cluster Mount

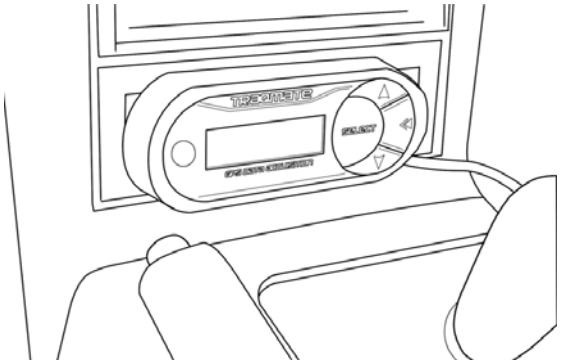
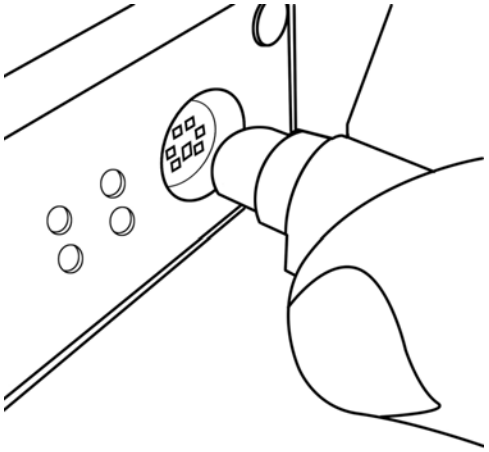


Figure 6 - DU Console Mount

Connecting to the Sensor Unit



After connecting the DU to the SU using the DIN extension cableturn the display unit on by pressing the power button. The DU will briefly display the Firmware revision number of the SU and the DU. If instead,

*** SU NOT CONNECTED ***

is displayed, there is no communication between the SU and DU and the system will not work for data collection. You can still upload sessions and download configuration to the DU.

Possible Remedies:

- Ensure SU has power.
- Ensure DIN Extension cable is firmly plugged into both the DU and SU.
- Ensure SU is in operable state. Cycle power on SU.
- Ensure SU has proper firmware.
- Ensure DU has proper firmware.

If you see the message

SW Mismatch, Reload

then the firmware in the DU and SU are incompatible. Reload the firmware of both the SU and DU with the latest downloads available on the traqmate.com website and try again.

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Traqmate Basic

System Description

Traqmate Basic is the easiest form of data acquisition. You can literally just Velcro the unit into a car and get very sophisticated results in a matter of minutes. Data is stored in Flash memory inside the Sensor Unit and can be downloaded through the COM serial port on the front panel of the unit.

Controls

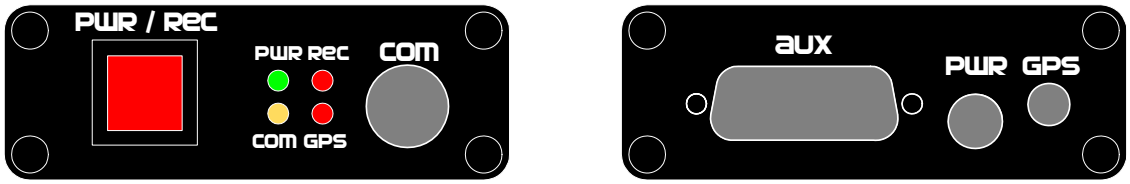

Figure 7 - Sensor Unit Front and Rear Panel

The front panel contains a power switch button, four LED lighted indicators, and a communications port.

PWR / REC – Power Switch Button

- Turns unit on - push button once, “PWR” LED goes on
- Turns Record on - push button while “PWR” LED is on and “REC” LED goes on; a second push and the “REC” LED goes off
- Turns unit off - hold button down until “PWR” LED goes off

LED Light Displays

- “PWR” LED - lights green when power is on
- “REC” LED - lights red when Record is turned on
- “COM” LED - lights yellow when Communications is in progress on the COM port
- “GPS” LED - flashes red (when in Record mode) to indicate that you have obtained GPS coverage. The rate of flashing indicates the sampling rate currently selected.

COM – Communications Port

- Plug the Traqmate Display Unit (DU) into the Sensor Unit
- Plug in a PC communications cable to download into Traqview

The back panel contains an auxiliary port, a GPS port, and a power port.

PWR – Power Port

- Plug in the cigarette lighter power adapter
- Plug in the power cable from the car battery power
- Plug in the battery pack power cable
- Plug in the AC adapter power cable

GPS – GPS Antenna Port

- Plug in the GPS antenna

AUX – Auxiliary Port

- Auxiliary connector port for digital, analog, and RPM sensors using the TraqData, TraqData II, TraqTach, or TraqSync units.

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Traqmate Complete

System Description

Traqmate Complete builds on the Traqmate Basic simplicity to add immediate feedback to the driver in the form of lap times and other information on a Display Unit (DU). It also provides more visibility and control of the collected data and useful tools for vehicle performance tuning. The DU provides complete control capability allowing the Sensor Unit to be remotely mounted. Data is stored inside the Display Unit and can be extracted using the mini-USB port on the end of the unit.

Controls

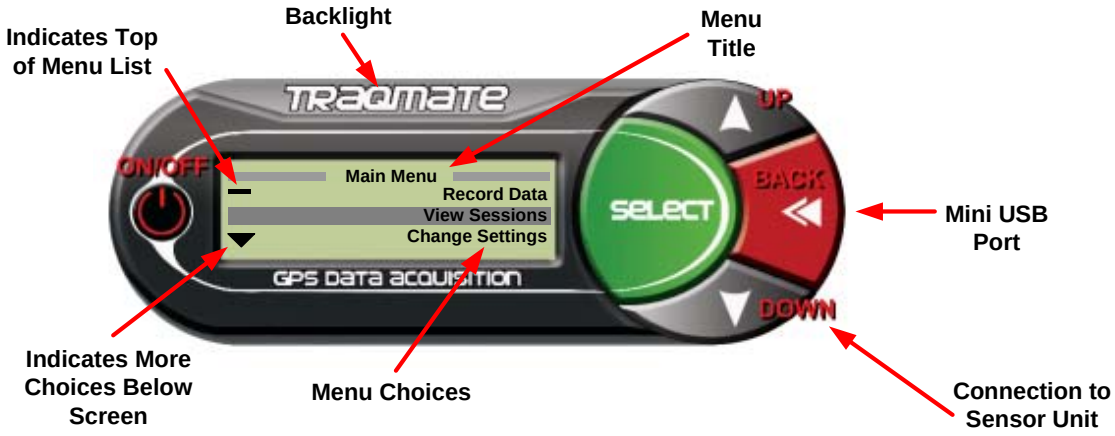

Figure 8 - Display Unit Controls

The DU contains six buttons, a graphical LCD screen, a DIN cable to connect to the Sensor Unit, and a mini-USB port for connection to a computer.

ON/OFF – Power Switch Button

- Turns unit on - push button once, startup screen appears and “PWR” LED goes on in the Sensor Unit
- Turns unit off - hold button down until signoff screen appears on LCD display and “PWR” LED goes off in the Sensor Unit

Traqmate Logo – Backlight Button

- Turns LCD backlight on/off – toggles LCD backlight on/off

Select Button – Executes Menu Functions

- Selects highlighted items on the LCD display screen

Back Button – Exits Menu Functions

- Goes up one level in menus
- Exits a mode such as lap timing and returns to menu

Up Button

- Press to go up one item in a list

Down Button

- Press to go down one item in a list

Menu System

All of the Display Unit features are accessible through a text menu system. To access a feature use the UP and DOWN buttons to highlight the item you want on the screen. Press **SELECT** to activate that item. Some items actually perform a function while others go to other menus. This chart shows the menu tree.

- **Main Menu**
  - **Record Data**
    - **Laps –** Enters lap timing mode with historical Predictive Lap Timing
      - **Choose Start / Finish –** Unit is waiting for driver to choose a Start / Finish location
      - **Looking for Start / Finish** – Unit is waiting for vehicle to cross Start / Finish Line
        - **Erase Start / Finish –** Erases Start / Finish for chosen track
    - **Qualifying –** Enters lap timing mode with single session Predictive Lap Timing
      - **Choose Start / Finish –** Unit is waiting for driver to choose a Start / Finish location
      - **Looking for Start / Finish** – Unit is waiting for vehicle to cross Start / Finish Line
        - **Erase Start / Finish –** Erases Start / Finish for chosen track
    - **Autocross/Rally –** Enters auto-launch mode with separate finish line
      - **Select to Stage –** User presses select on starting line
      - **Ready to Launch –** Timing starts automatically when vehicle launches
        - **Erase Start / Finish –** Erases Start / Finish for chosen track
    - **Segment Timing** – Enters segment timing mode with separate start and finish
      - **Choose Start –** Unit is waiting for driver to choose a Start location
      - **Looking for Start** – Unit is waiting for vehicle to cross Start Line
        - **Erase Start / Finish –** Erases Start & Finish for chosen track
    - **Drive** – Enters data recording mode with directional indicators[1]
    - **Tach & Speedo** – Enters data recording mode with tach and speedometer onscreen[1]
    - **Gauges** – Enters data recording mode with analog/digital/rpm gauges onscreen[1]
    - **G-Forces** – Enters data recording mode with G meter onscreen[1]
    - **Gs & Location** – Enters data recording mode.
      - Shows x, y G-forces, GPS precision (<250 good), date and time, GPS location in lat/lon, heading, speed, temperature, and # of satellites in use (>5 good).
    - **Inputs** – Enters data recording mode with analog, digital inputs, and RPM onscreen
  - **View Sessions**
    - **List of Recorded Sessions**
      - **View Laps** – Steps through recorded lap times
      - **Erase Data** – Erases selected session
      - **Session Detail –** Information about the selected session. Displays driver, car, track, session memory usage, start date/time, end date/time, laps recorded, sampling rate, and temperature at start.

<continued on next page>

[1] Note: UP or DN cycles through the other screens in any of these modes.

Change Settings

Driver – Pick from list of drivers entered in Traqview

Vehicle – Pick from list of vehicles entered in Traqview

Track – Pick from list of tracks entered in Traqview

Sampling Rate

10 Hz – Selects 10 samples per second

20 Hz – Selects 20 samples per second **** BEST ALL AROUND CHOICE ****

40 Hz – Selects 40 samples per second

Erase Sessions – Erases all sessions but retains drivers, vehicles, tracks

Pack Sessions – Reclaims memory for more recording

GMT Offset – Changes time offset from Greenwich Mean Time

Contrast – Changes LCD contrast

UP or **DOWN**

Units

US Standard – Shows speed in MPH and distance in feet

Metric – Shows speed in KPH and distance in meters

Lap/Qualifying Settings – User selectable parameters related to lap timing

LapTime Hold – in seconds. Changes length of time laptime is held at Start/Finish.

UP or **DOWN**

Graph Scale – Changes the scaling of the graph for Lap Timing mode

-0.5 to 0.5s – Full scale left is -0.5s. Full scale right is 0.5s

-1 to +1s

-2 to +2s

-5 to +5s

-10 to +10s

Track Length – Selects the length of track. This affects the time between updates of the predictive lap graph in Lap and Qualifying Modes.

Short (less than 1 mile)

Med (1 mile to 5 miles)

Long (greater than 5 miles)

Factory Defaults – Erases all sessions, drivers, vehicles, and tracks

Current Status

Shows record time available at the current settings, number of sessions available, battery power level, and which TraqData inputs are selected.

Other Features

GPS Compass – Enters non-recording GPS compass mode.

Shows time, speed, and heading.

GPS Information – Enters non-recording GPS information mode.

Shows x, y G-forces, GPS precision (smaller is better), date and time, GPS location in latitude/longitude, heading, speed, temperature, and number of satellites in use (larger is better).

Check Inputs – Shows voltage for all analogs, signal level for digitals, and RPM.

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Display Unit Icons

When Traqmate Complete is used with a ChaseCam PDR video recorder and the TraqSync cable or the TraqData II, the video recorder status is shown on the display in the form of icons whenever the Traqmate is in the menu system. The icons are shown in the upper right corner of the display.

The READY icon (open circles) indicates the PDR is ready to record. This is shown when the PDR has started up successfully with a camera plugged in and a Compact Flash card in place. The unit should be in this state before attempting to record.

The NOT READY icon (broken circles) indicates the PDR is not ready to record. This is usually due to the Compact Flash card being out of the recorder.

The RECORDING icon (closed circles) indicates the PDR is recording. This icon will only be seen if recording is started on the PDR manually.

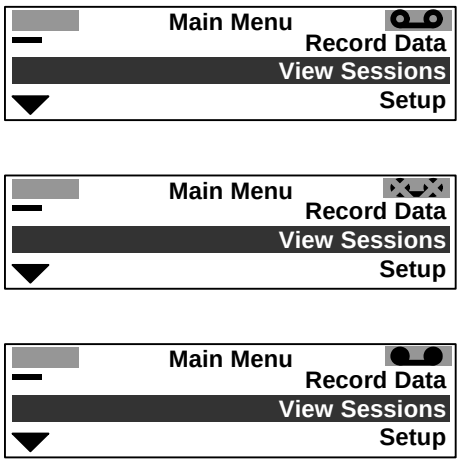

Figure 9 - DU ChaseCam Status Icons

Features

Lap Timing

The lap timing feature measures the interval of time between passes of a chosen spot (Start / Finish Line). It uses both location and heading to determine the exact spot to 1/10th second accuracy. It is best to set the Start/Finish on the racing line and you must be heading in approximately the same direction as the reference lap for the timing to work.

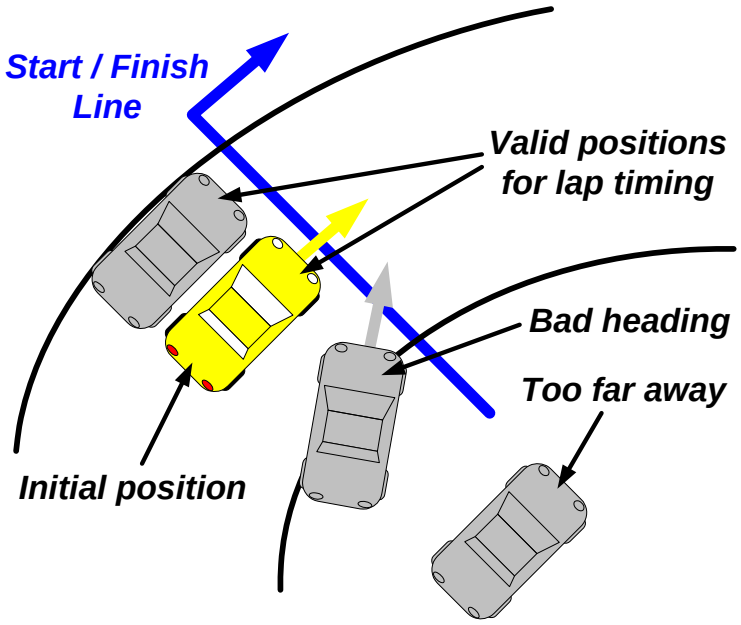

Figure 10 - Lap Timing

The Start/Finish Location is stored on the Display Unit for each track, so once you enter it you should not have to enter it again unless you delete the track from memory or upgrade your DU software.

To use the lap timing feature Select “Record Data” from the Main Menu and then Select “Laps”. You will see

Figure 11 - Acquiring GPS Screen

until GPS signal is acquired. If this takes more than a minute, check your antenna connection and ensure that the antenna has a clear view of the sky.

Once Traqmate has GPS signal, it will check to see if there is a Start/Finish position stored for the current track. If not, you will see

Figure 12 - Recording a Start / Finish Location

Proceed around the track until you reach the Start/Finish line. Make sure you cross the line the same way that you will when driving at full speed. As you reach the line press the SELECT button to record the Start / Finish line and save it in permanent memory. At this time the Timing Screen will appear.

If you have already recorded a Start / Finish location for the chosen track, the following screen will appear. The selected track is shown on the screen.

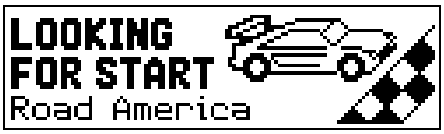

Figure 13 - Searching for Start / Finish Line

This will stay onscreen until you cross the Start / Finish line at which time the Lap Timer Screen will appear. The difference between Lap and Qualifying Mode is that Lap mode will use stored predictive lap timing information and compare against it. Qualifying mode assumes you are only interested in the current session and will not use historical information. Best predictive lap information from either mode is stored for future use.

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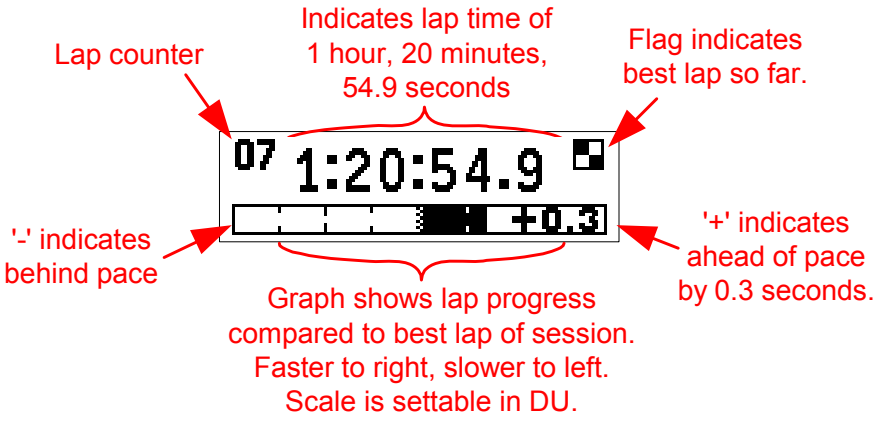
Lap counter
Indicates lap time of 1 hour, 20 minutes, 54.9 seconds
Flag indicates best lap so far.
07 1:20:54.9
+0.3
'-' indicates behind pace
'+' indicates ahead of pace by 0.3 seconds.
Graph shows lap progress compared to best lap of session. Faster to right, slower to left. Scale is settable in DU.

Figure 14 - Lap / Qualifying Timer Screen

NOTE: To clear a Start/Finish line, press SELECT while the "Looking for Start" screen is displayed. That will erase the Start/Finish line from permanent memory and transfer to the "Press SELECT at Start/Finish" screen.

On either timing screen, the numbers will start over whenever the Start / Finish line is crossed and the lap counter will increment. The lap time from the previous lap will be held onscreen for 1 minute to allow time for viewing, and then the counting will resume. The lap hold time is configurable through the Display Unit menu system.

In the Lap Timer example shown, the graph is approximately 30% of full positive range. Therefore, if the graph scale is set to –1.0 to +1.0 seconds, this screen would indicate that the driver is ahead of his best lap so far by 30% of 1 second = 0.3 second. At a typical track, the graph will update every few seconds.

If no reference lap is available in memory, the graph will be blank except for a – and + sign until you complete a lap that can be used as a reference.

Using the Predictive Lap Timer

If you are like many Traqmate users, once you have the graph, you will wonder how you did without it. The real-time feedback on your driving is there whenever you need it and can be used in several ways. Needless to say, you should concentrate on driving, not the Traqmate screen, but if the Display Unit is well-positioned, you can pick up the graph at a glance and get very useful information.

The most obvious use is Qualifying Mode. If you are trying to put down your best lap and you get slightly held up by another car, the Predictive Lap Timer will tell you if you lost too much time and should slow down and find a gap in traffic or whether you should put your head down and finish the lap.

In Lap Mode, you can use the graph and numbers as a general reference. Say you enter Turn 3 and the PLT says +0.3. If you exit Turn 3 at +0.4 you picked up some time. This can be useful for trying out new lines or just working on braking less and carrying speed.

Sometimes there is an opportunity to have a pro driver put down a reference lap in your car. With that information stored, you can use the Predictive Lap Timer for real-time feedback and improvement. This can also work by swapping Traqmate DUs with a friend to see who is faster where.

Sometimes, when you return to a track it is difficult getting down to the lap times that you have done there previously. Unless you have cleared the data, your reference lap will still be there for

the track. Of course overlaying your data in Traqview will show you where you are slow, but the Predictive Lap Timer will provide that information while still on the track while you can correct it.

Predictive Lap Timer Settings

There are three settings available to fine-tune the Predictive Lap Timer to a particular situation, Lap Time Hold, Track Length, and Graph Scale. These are accessible on the Display Unit under the Change Settings – Lap/Qual Settings.

The default settings work fine for most situations.

At some tracks it might be difficult to look at the timer right at Start/Finish. You can change the amount of time the Lap Time is held after passing the Start/Finish before resuming the counting timer. This is set in seconds. If you set this to 0, it will not hold the time at all. If you set it to a time greater than the lap time, the time will be held until the Start/Finish is passed the next time.

On most tracks, the Predictive Lap Timer will update the graph and numbers every 6-10 seconds. When racing on short courses (< 1 mile), you can get more frequent updates on the Predictive Lap Timer. For very long courses (> 5 miles), you may want to spread out the updates. If you choose the wrong setting, Traqmate will run out of intermediate storage and your Predictive Lap Timing will not be accurate at the end of the lap. The default MED setting is good for any lap under 5 miles in length.

Depending on the variability in lap times that you expect, you can expand or contract the graph scale. If you are working on that last tenth, you might choose the –0.5 to 0.5 scale. If you are running the Nürburgring, you might expand the scale to –10s to 10s. Once again, for most applications the default setting is fine.

Autocross / Rally Mode

This mode is intended for non-circuit applications with a separate Start and Finish line such as Autocross, Rally stages, and Hillclimbs. It will set the start line automatically and the user can set the finish line. When analyzed in Traqview, the data will automatically appear in Separate Start/Finish line (Rally) mode. It can also be used to time an autocross.

Select Record Data / Autocross Rally Mode on the Display Unit. After GPS signal is acquired, you will be presented with the Stage Screen.

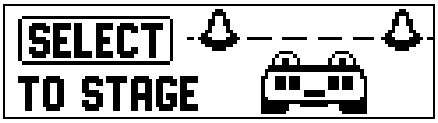

Figure 15 - Autocross/Rally Stage Screen

When the vehicle is positioned on the starting line, press the SELECT button to enable the launch trigger. The following screen will appear. Data and video recording will begin.

Figure 16 - Autocross/Rally Launch Screen

When the vehicle is launched, the Start location will be recorded and timing will start automatically. If no Finish Line has been set, the user will be prompted to hit SELECT at the finish line. Otherwise, timing will automatically stop when the vehicle crosses the Finish Line.

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If a Finish Line exists for the chosen track, it can be cleared by pressing SELECT button when the Ready to Launch screen is displayed.

Timing an Autocross

To time an autocross, set up the course and run it at a moderate speed with a vehicle using Traqmate Autocross mode. Set the Finish Line as precisely as possible. By placing the Traqmate in each vehicle on the starting line and recording the time displayed on the DU at the finish line, you can effectively practice an autocross or even use Traqmate for the timing. You can employ multiple Traqmates by transferring the Finish Line coordinates from unit to unit using Traqview.

Segment Timing Mode

This mode has several possible applications, a rolling start autocross or hillclimb, timing a slalom course, or detailed in-car feedback on a circuit track. When analyzed in Traqview, the data will automatically appear in Separate Start/Finish line (Rally) mode.

The concept for this mode is very similar to Lap Timing except that there is a separate Start and Finish. Once you have set the Start and Finish, Traqmate retains those positions for future use at that track and Traqview will use them for analysis.

When the mode is selected, you will be presented with either the “Looking for Start” screen or a “Press Select at Start” screen depending on whether a Start Position has been created. After passing the Start location, timing will begin.

If no Finish location is stored, you will be prompted to press the Select button at the Finish. If a Finish is present, the timing will stop at that point.

On subsequent passes, timing will start at the Start location and stop at the Finish location. The Predictive Lap Timer will show intermediate progress against the best reference lap. Note that the reference lap is stored from session to session as in Lap Mode.

If a Start and/or Finish Line exist for the chosen track, they can be cleared by pressing the SELECT button when the “Looking for Start” screen is displayed. Clearing the Start and Finish will also erase the stored intermediate times used for Predictive Lap Timing.

Using for Closed Circuit Feedback

Perhaps you wish to really work on just one section or turn on a racetrack. You can enter Segment Timing mode and set the Start before the turn and the Finish after the turn. This will allow you to concentrate the timer on just that small segment by changing the Predictive Lap Timer to Short Course and expanding the graph scale. Every time you pass through the segment you will get detailed feedback on how well you and your vehicle are performing.

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Traqview / TraqStudio Analysis and Configuration Program

Traqview is the source for configuring, uploading, and analyzing data from your Traqmate. After installation, you can launch the program from the Windows Start Menu or a desktop icon. TraqStudio includes all Traqmate functionality, along with video integration so that you can play back data and video together and save video files with overlayed data graphics.

Traqview Screen Layout

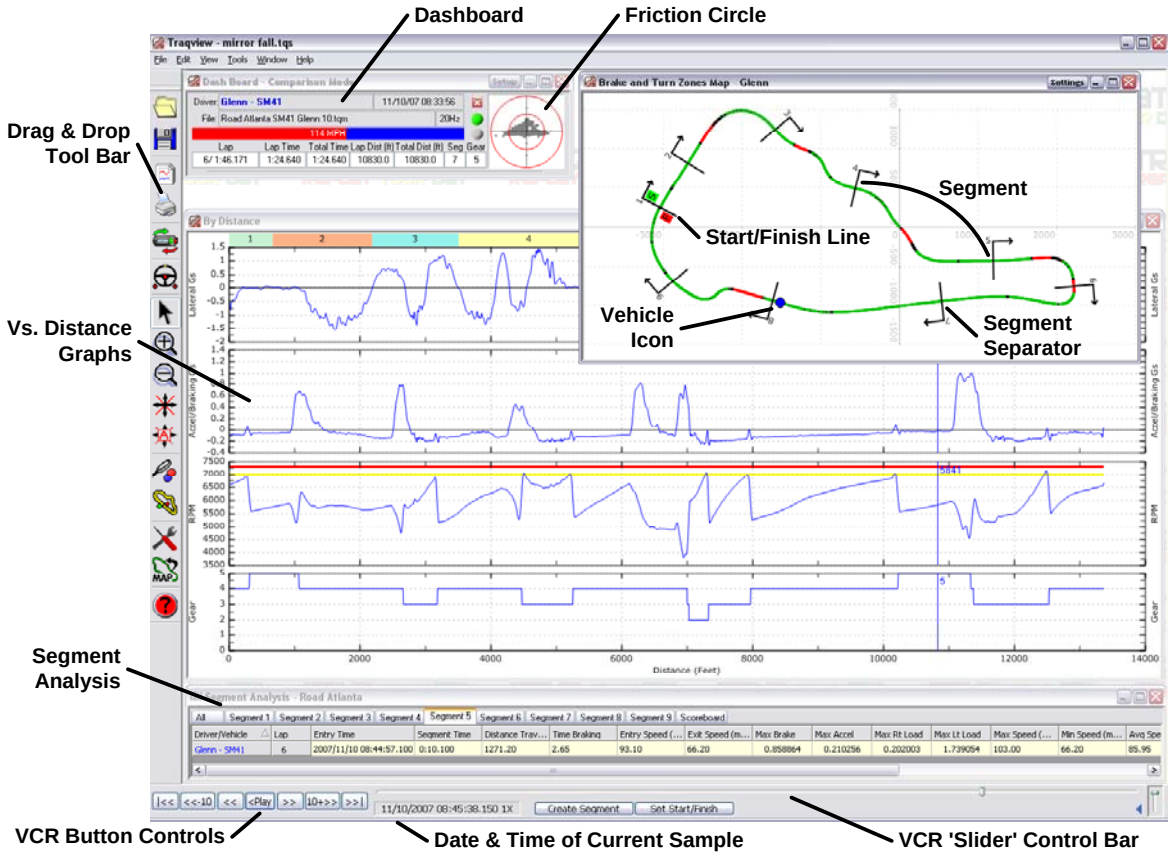

Figure 17 - Traqview Screen Layout

Traqview is visual and interactive with moving elements such as vehicle icons that traverse the track, graph and friction circle cursors that move, and (optionally) synchronized video playback. This screen shows many of the elements that Traqview employs to control and present information about driver and vehicle performance.

Toolbar Buttons and Controls

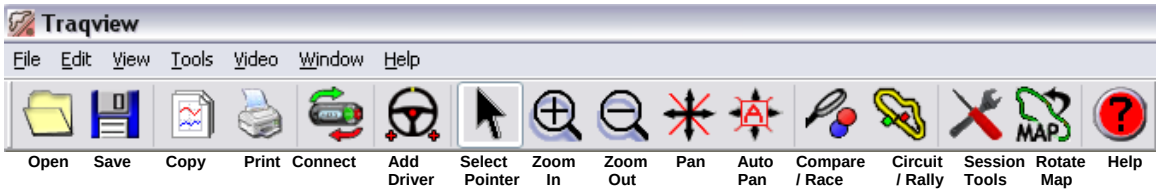

Figure 18 - Tool Bar Buttons

Menu Options

File

Open – opens a session file (.tqm) or an analysis file (.tqs)
Close – closes current file
Save – saves current analysis as a .tqs file
Save As – saves current analysis to a name chosen by user
Add Driver – opens a session file and adds driver to dashboard
Export Graph/Form– saves current graph as an image file or form as a .CSV text file
Export Data – saves any of the currently loaded data sets as a .CSV text file
Print – prints the currently selected graph
Print Preview – shows how the print output will appear
Print Setup – select printer and printer options
Exit – exits Traqview / TraqStudio program

Edit

Copy – copies currently highlighted window to Windows clipboard

View

Toolbar – toggles toolbar on/off
Auto Pan –causes selected driver to always stay within track map and graph windows
Driver List – choose driver for window to follow on track
Pointer – selects the pointer tool (for moving Start/Finish Line and Manipulating Segments)
Zoom – selects the Zoom In tool (for magnifying track or graphs) Shift key will invert Zoom.
Pan – selects the Pan tool for dragging track and graphs around in the window
Rotate Map – reorients the map by 90 degrees to optimize screen space
Refresh – resets graphs and map back to starting point, redraws screens

Tools

Session Upload – connects to Traqmate to upload session information
User Setup – connects to Traqmate to setup user information
Unit Information – connects to Traqmate to change user information
Firmware Update – connects to Traqmate to update SU or DU firmware
Driver Setup – opens the setup window to select graphs and laps
Session Tools – access to Swap Axis, Time Zone, Align Sessions, Trim Sessions, Data (names and vehicle weight), and Gear tools
Segment Tools – access to Segment Create, Delete, and AutoCreate tools
Brake / Turn Zone Settings – access to Brake & Turn Zone G Thresholds and Color Key
Options – controls Traqview local options including default file path, units, and startup screens

Video (TraqStudio Only. Only Appears When Video Window is Open)

Open Video File – used to choose another video file
Settings – opens/closes video settings pop-up menu for synchronization
Show Dash – causes the video dashboard with gauges to appear/disappear
Write Video – causes the video writing wizard to appear to select output options

Window

Close All – closes all windows
Window List – choose a window to display on top

Help

About Traqview – displays Traqview version information and link to Traqmate website

General Traqview Options

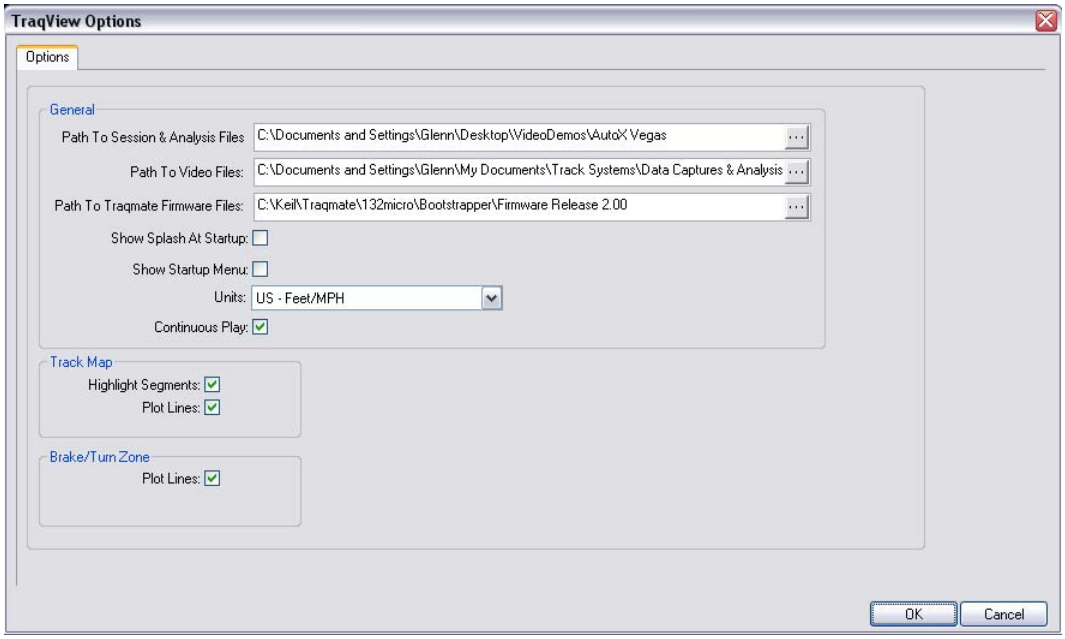

Figure 19 - General Traqview Options

Traqview can be tailored to your individual needs through the Tools/Options menu.

This menu screen will allow you to change the default path to your Traqmate files so that sessions uploaded from the Traqmate and File Opens from your PC hard disk will begin in a known location. For example, if you create a Traqmate folder in your My Documents folder and then create folders for each event below that, you might wish to have Traqview start looking in the My Documents/Traqmate folder.

In order to speed access to Traqview, you can use the Options menu to disable the Splash Screen at startup and the Startup Menu.

This screen will allow you to change the units Traqview uses for display. Choices are US Standard (miles, feet) and Metric (kilometers, meters).

The Continuous Play option will cause your data/video playback to start over when it reaches the end.

Highlighting Segments will cause each segment to appear with a pastel color in order to easily distinguish them on the Track Map and Distance Graph.

For both the Track Map and Brake/Turn Zone Map you may choose to ‘connect the dots’ which will draw a line between data samples. This can be useful when zooming in to inspect driving lines.

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Files

There are three types of files that Traqview uses: .tqm files are compressed session files that come right from the Traqmate, .tqs files are compressed analysis files which are saved from Traqview, and .tqc files are firmware update files for the Traqmate Sensor Unit and Display Unit.

Opening Files

Traqview can open .tqm or .tqs files using the File Open menu directive or by double-clicking on a file in Windows Explorer. Opening a .tqs file will close the current file. Opening a .tqm file will add the driver to the Dash Board and can be placed on the Track Map or any Graph.

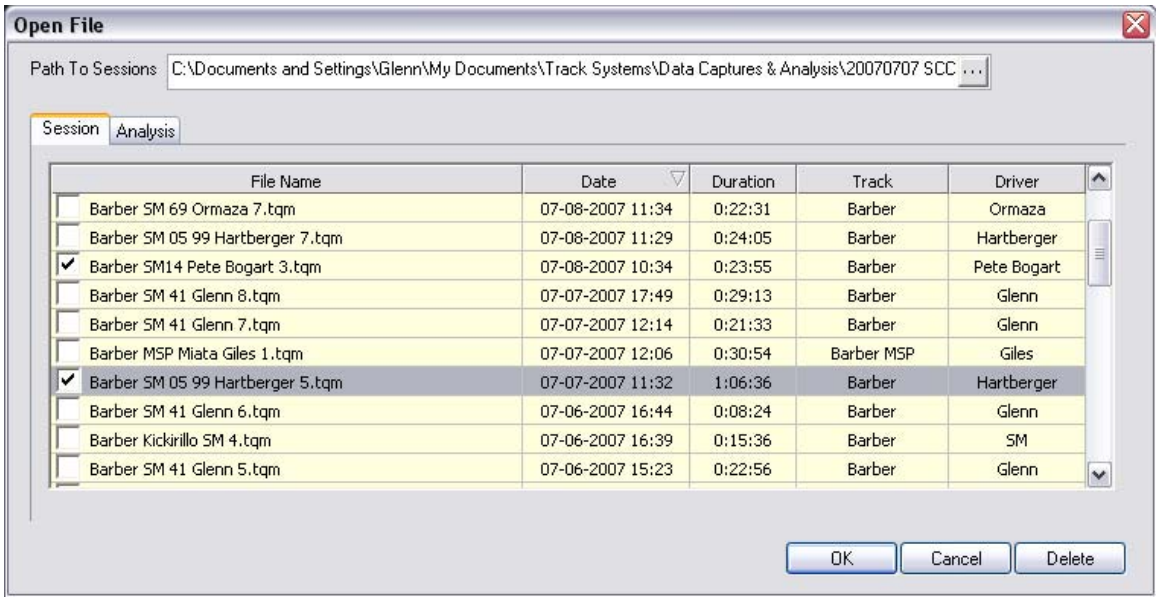
Open File
Path To Sessions
C:\Documents and Settings\Glenn\My Documents\Track Systems\Data Captures & Analysis\20070707 SCC
Session
Analysis
File Name
Date
Duration
Track
Driver
Barber SM 69 Ormaza 7.tqm 07-08-2007 11:34 0:22:31 Barber Ormaza
Barber SM 05 99 Hartberger 7.tqm 07-08-2007 11:29 0:24:05 Barber Hartberger
Barber SM14 Pete Bogart 3.tqm 07-08-2007 10:34 0:23:55 Barber Pete Bogart
Barber SM 41 Glenn 8.tqm 07-07-2007 17:49 0:29:13 Barber Glenn
Barber SM 41 Glenn 7.tqm 07-07-2007 12:14 0:21:33 Barber Glenn
Barber MSP Miata Giles 1.tqm 07-07-2007 12:06 0:30:54 Barber MSP Giles
Barber SM 05 99 Hartberger 5.tqm 07-07-2007 11:32 1:06:36 Barber Hartberger
Barber SM 41 Glenn 6.tqm 07-06-2007 16:44 0:08:24 Barber Glenn
Barber Kickirillo SM 4.tqm 07-06-2007 16:39 0:15:36 Barber SM
Barber SM 41 Glenn 5.tqm 07-06-2007 15:23 0:22:56 Barber Glenn
OK
Cancel
Delete

Figure 20 - File Open Screen

The Open File screen has tabs for session (.tqm) files and for analysis (.tqs) files. Each file is listed with its recording data, duration of the session, track and driver name. You can select more than one file to open together. You can also delete session and analysis files by selecting one or more and pressing the 'Delete' button. Deleted files are transferred to the Windows Recycle Bin so they can be recovered if accidentally removed.

Saving Files

Traqview can only save .tqs files. If you open a .tqm file it becomes part of an analysis and is saved as a new .tqs file.

Adding Drivers

Adding a driver is the equivalent of opening another .tqm file to add to an analysis. To compare separate laps in the same session, add it twice.

Exporting Graph Images and Segment Analysis Table

You can export graph or track images as JPEG, TIFF, or GIF files and then view or print them using a graphics program such as Windows Picture Viewer. You can export a Segment Analysis table as a .CSV (comma separated variables) text file for use in a spreadsheet. This includes lap times, lap numbers, and many performance measurements.

Exporting Data Files

You can export the raw data in a .CSV (comma separated variables) text file for use in a spreadsheet or for importation into the TrackVision video integration software.

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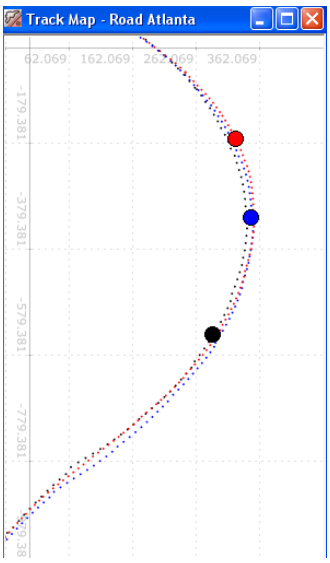
Viewing Options

Traqview allows you to create many views of your data at one time. You can watch the cars go around the track, see the G-forces in action on the Friction Circle, and track the speed on the Velocity vs. Distance Graph. There are several tools available to help you get just the right view into your data.



Zoom

Zoom lets you magnify the graph to better see driving lines, braking points, and acceleration points. There are two Zoom buttons, Zoom In and Zoom Out. When either is selected, holding the Shift key will reverse the Zoom direction. You can tell you are in Zoom mode because the cursor will change to a magnifying glass. Zoom In has a "+" magnifier while Zoom Out has a "-" magnifier.

On the Track Map, Zoom magnifies the portion of the track that you click on. On graphs, Zoom just magnifies the time or distance axis (horizontal direction) so that you can see more detail. If you need more vertical resolution, stretch the window upward.

To exit Zoom mode, click on the Pointer Menu bar button.

Pan

Often, if you have magnified a track map or graph, your view is restricted to a small part of the overall picture. To move the view without Zooming back out, use the Pan tool. Click on the Pan Menu bar button and the cursor will change to four arrows. To move around, click and hold the mouse and drag the picture in the window in the direction of the data you wish to view.

To exit Pan mode, click on the Pointer Menu bar button.

Auto Pan

If you want to play back vehicles moving on the track or a graph while Zoomed in, click on the Auto Pan button to activate Auto Pan mode. You can tell you are in Auto Pan mode because the button stays depressed until pressed again.

In Auto Pan, the screens will always ensure that the designated Reference Driver is viewable in the graph or track map at all time. To change the Reference Driver use the View Menu at the top of Traqview. Select View / AutoPan / DriverName.

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Exchanging Information with Traqmate

In order to tune Traqmate to your personal needs, there are several settable options in the Traqmate unit. In Traqmate Basic, these are configurable through the Traqview program. In Traqmate Complete, the same options are configurable through Traqview and many are also configurable through the Display Unit menu system.

To get your sessions into Traqview for playback you must connect to the Traqmate.

Connecting to Traqmate

Connecting is different for Traqmate Basic (SU only) and Traqmate Complete (DU). Please follow the instructions for the system that you have.

Traqmate Basic (SU Only)

Supply power to the unit. This can be done by leaving the unit in the car, using the TraqPaq battery pack accessory, or using the Traqmate AC adapter accessory.

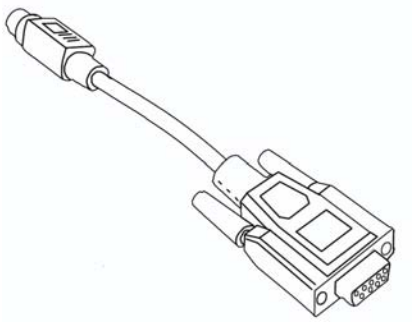

Figure 21 - DIN - Serial Adapter Cable

Plug the DIN (round plug) into the Traqmate COM port on the front of the unit. Plug the 9 pin serial adapter cable into your PC. If the DIN cable is too short, use a serial extension cable (available at any computer store).

Click on the Upload Menu Button

You will be presented with the Traqmate Comm Settings Screen. If you know the port that you will be using, enter it and click on 'Connect to Sensor Unit'. If you do not know the port number, choose 'AutoConnect' and the system will search your ports for the Traqmate.

Traqmate Complete (DU)

There is no need to supply power to the unit; power is supplied through the USB cable. Plug the mini-USB to USB cable between the DU and your computer. When properly installed, the computer will recognize the Traqmate as a valid USB device.

On most systems, Traqview will detect the USB connection and automatically connect. If you are presented with the Traqmate Comm Settings Screen, choose 'AutoConnect'. If the port cannot be found automatically, go to the Windows Device Manager to find the COM port assigned to the Traqmate USB Device and enter that number. Click on 'Connect to Display Unit'.

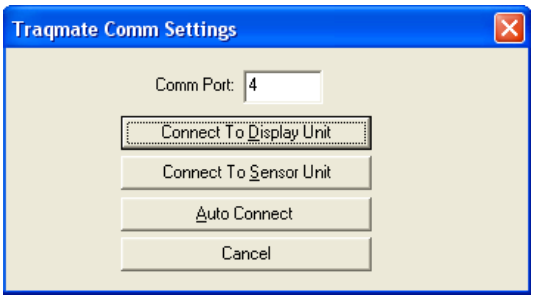

Figure 22 - Traqmate Comm Settings

Unit Info Screen

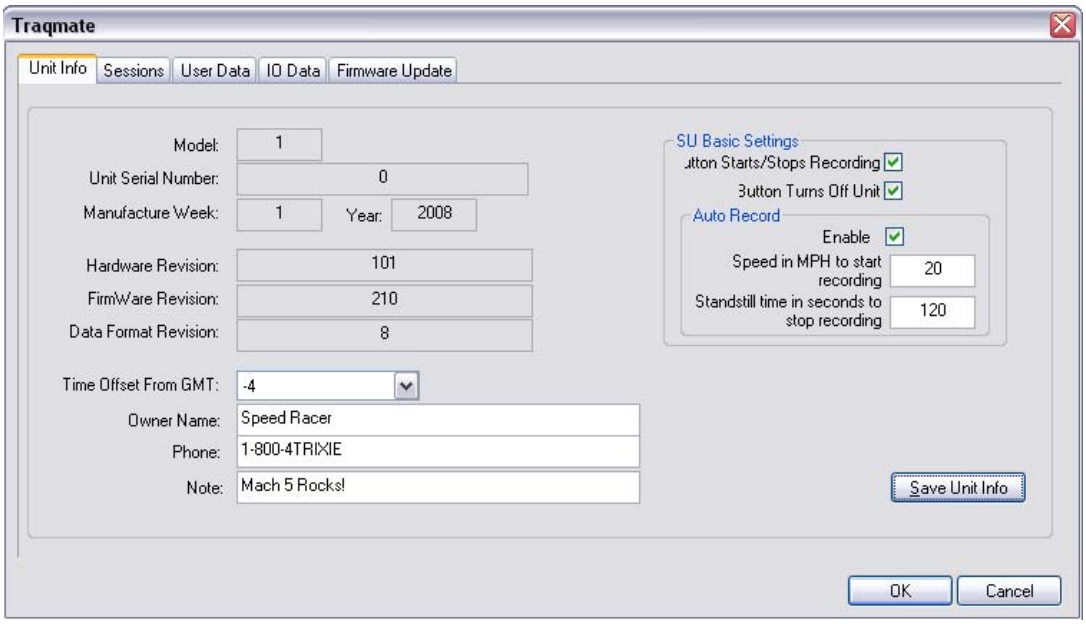

Figure 23 - Unit Info Screen

Time Offset – Enter your time zone offset (in hours) from Greenwich Mean Time. This will cause your recorded times to show your local time instead of GMT. Some common values are:

Alaska	**-9**
US Pacific Time	**-8**
US Mountain Time	**-7**
US Central Time, Central America	**-6**
US Eastern Standard Time	**-5**
London	**0**
Paris, Rome, Amsterdam	**+1**
Athens	**+2**
Moscow	**+3**
Beijing, Hong Kong, Perth	**+8**
Tokyo, Seoul	**+9**
Melbourne, Sydney	**+10**
New Zealand	**+12**

For USA Daylight Savings, use above values + 1.

Owner Name – Enter your name. This appears on the Display Unit screen when powered up.
Phone – Enter your contact information. This appears on the Display Unit when powered up.
Note – Enter anything you like. This only appears in the Traqview screen.

To save the information in the Traqmate you must click on the Save Unit Info button.

SU Basic Settings – These appear only when connected to a Traqmate Basic Unit.
Button Starts/Stops Recording – Enable/disable button for recording
Button Turns Off Unit – Enable/disable button for power off

Auto Record Enable – Allows unit to start recording at a chosen speed.
Start Recording Speed – Speed in MPH where unit will start recording.
Standstill Time – Time in seconds where if the unit is stationary, recording will stop.

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User Data Screen

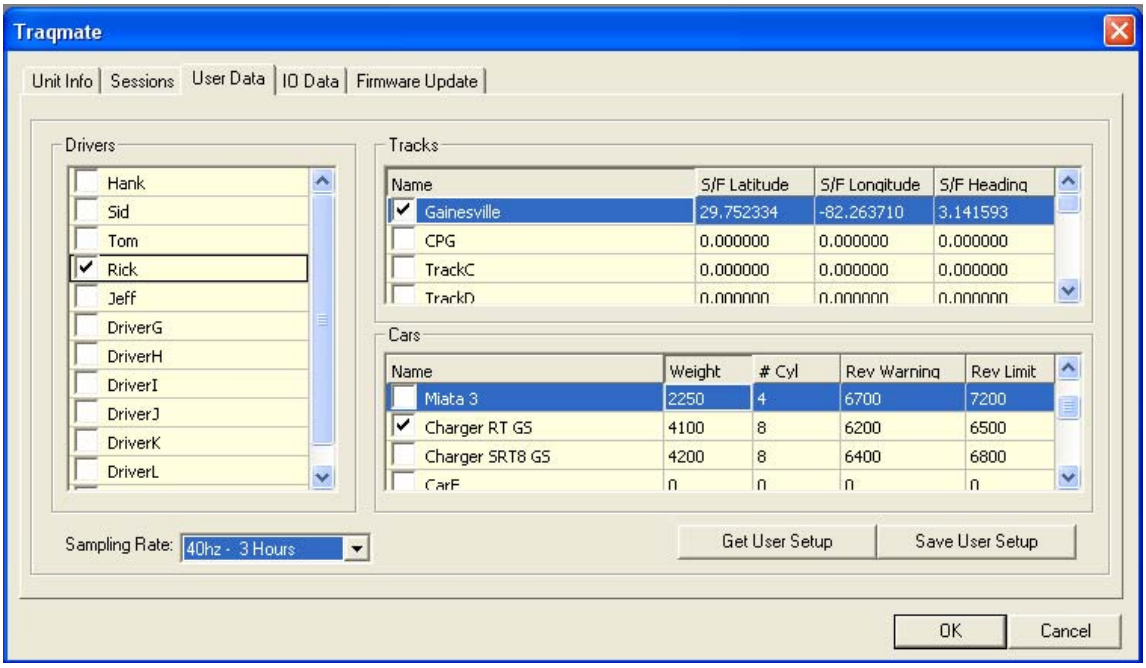

Figure 24 - User Data Screen

Drivers – Enter your drivers' names. The driver with the check mark is the default driver for the next recorded session.

Tracks – Enter your track names. The track with the check mark is the default track for the next recorded session. **NOTE**: Removing a track will erase any Start / Finish line and Predictive Lap information that might be recorded for that track.

You can type in the Start/Finish information for a new track before you arrive by looking it up at Traqmate.com or using Track Facts to copy from a previously recorded session. Otherwise, this information is created when you press the Select button during the 'PRESS SELECT AT START/FINISH' screen on the Display Unit.

Cars – Enter your vehicle names and other information. The vehicle with the check mark is the default vehicle for the next recorded session.

This is where you put in the number of cylinders used for the on-screen tachometer, the Traqview graphs, and TraqStudio tach display. Since tach signals vary by car and which signal you choose, take your best guess and try it. If the tach reads double, double the number. If it reads half, halve the number. Here are some general rules:

Attaching to negative side of coil – enter number of cylinders. Enter 0 for kart or 2-stroke.
Attaching to a fuel injector or coil-on-plug signal – enter 2.
Attaching to an ECU or electronic tach – unpredictable, start with number of cylinders.

The Rev Warning is the RPM where the DU will invert the screen to tell you it is time to shift. This is displayed as a yellow line in Traqview. The Rev Limit does not actually limit revs. It is displayed as a red line in Traqview. The Rev Limit and Weight will be used to calculate gearing, as well as horsepower and torque in an upcoming release.

Sampling Rate – Choose a sampling rate that is appropriate for the type of data you are recording. A higher rate is appropriate for shorter runs like dragstrip runs and autocross, whereas a slower rate would be best for a long endurance race. The default 20Hz is a good choice.

To save the information in the Traqmate you must click on the Save User Setup button.

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IO Data Screen

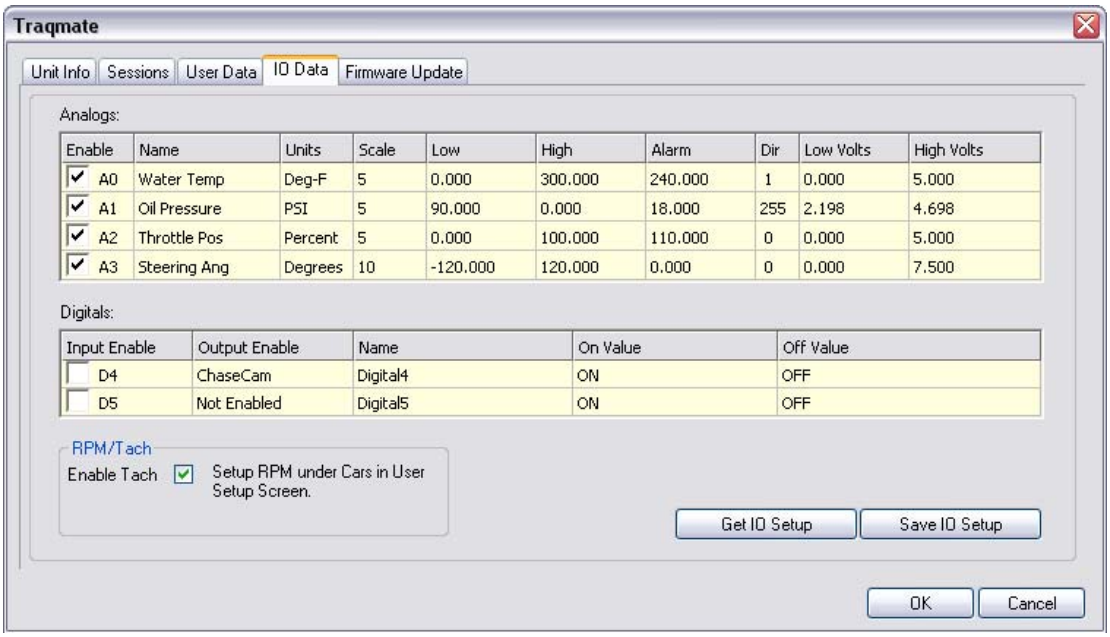

Traqmate
Unit Info
Sessions
User Data
IO Data
Firmware Update
Analogs:
Enable | Name | Units | Scale | Low | High | Alarm | Dir | Low Volts | High Volts
A0 | Water Temp | Deg-F | 5 | 0.000 | 300.000 | 240.000 | 1 | 0.000 | 5.000
A1 | Oil Pressure | PSI | 5 | 90.000 | 0.000 | 18.000 | 255 | 2.198 | 4.698
A2 | Throttle Pos | Percent | 5 | 0.000 | 100.000 | 110.000 | 0 | 0.000 | 5.000
A3 | Steering Ang | Degrees | 10 | -120.000 | 120.000 | 0.000 | 0 | 0.000 | 7.500
Digitals:
Input Enable | Output Enable | Name | On Value | Off Value
D4 | ChaseCam | Digital4 | ON | OFF
D5 | Not Enabled | Digital5 | ON | OFF
RPM/Tach
Enable Tach
Setup RPM under Cars in User Setup Screen.
Get IO Setup
Save IO Setup
OK
Cancel

Figure 25 - IO Data Screen

This screen looks complicated but that is only because the Traqmate inputs are very flexible. You only need this screen if you have a TraqData, TraqTach, or TraqSync input device.

Enable Tach – You must put a check in this box to display and record the RPM. You also must set the # of Cylinders value in the User Data/Vehicles menu.

Digital Inputs – Enter the name of your digital input points. Check "Input Enable" to enable recording of digital inputs. Notice that you get all or none. If you only have only one digital you can name the other one 'Rockets' to impress your friends.

The "On Value" and "Off Value" correspond to <3 Volts and >3 Volts on the actual TraqData input. It is possible that a signal may be inverted in which case you can swap ON and OFF. You can also use names like "Enabled", "Ready", or "Warning" to best describe the state of the digital input. These names will be displayed on the Display Unit gauge and in the Traqview graph.

Digital Outputs – Traqmate may be configured to output a digital signal when a pre-programmed event occurs.

There are currently three possible output values:

RPM Warning – Connects to ground whenever the RPM exceeds the RPM Warning threshold. This can be used to trigger a relay to an external shift light.

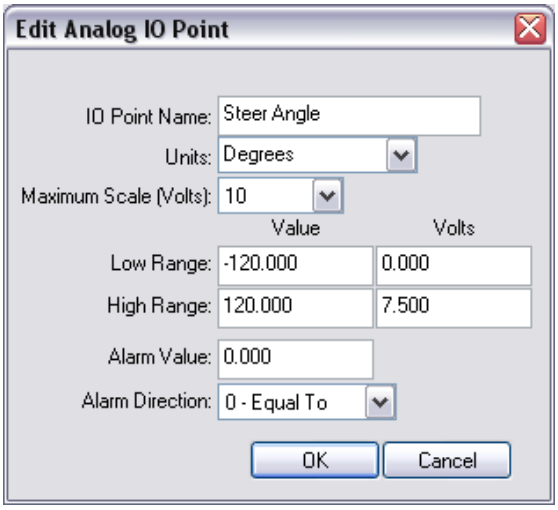
Analog Value Warning – Connects to ground whenever the corresponding Analog Input goes into the warning zone. Digital 4 can be a warning for Analog 0 and Digital 5 can be a warning for Analog 1. These outputs can be used to trigger a relay to an external warning light.

ChaseCam Digital Recorder Control – Connects to ground whenever the Traqmate acquires GPS Lock and enters recording mode. This is used with the TraqSync or TraqData II interface to

trigger the ChaseCam PDR 100 digital recorder so that video and data are synchronized for playback in the TraqStudio software.

NOTE: If you wish to record alarm events from a digital output, configure the digital as an input and an output.

Analogs – If you double click on an analog, you can edit all the information for that input point.



Enter the names of your analog input points. Check "Enable" to enable analogs individually. Enter the names of the units that you want displayed for that particular sensor. You can choose from a list of units or type in your own. For example, if A1 is a boost sensor this might be "PSI" or "BAR".

Next choose the maximum scale of the sensor. Choices are 5, 10, and 20 volts. For best resolution, choose the smallest one that your sensor does not exceed. Now choose the voltage range of the sensor within the maximum scale.

For example, your sensor might operate between 2.5 and 4 volts, so you would choose the maximum 5-volt scale. If this were a steering wheel angle sensor, the low range might be the voltage at the far left turning lock and high range might be the voltage at the far right turning lock. You can read the voltages on the "Check Inputs" screen on the Display Unit.

Most of the time you would not want to display the sensor in volts so you would put in the actual values that you want to be displayed at the opposite ends of the range. Using the same example, 2.5 volts corresponds to the left steering lock, which might be -120 degrees. The right steering lock would be +120 degrees. The unit would be entered as "Degrees".

You may also set an alarm value and direction. For example, if oil pressure dropped too low or temperature went too high. The alarm state is shown on Traqmate as a reverse screen (white on black) and can be used to trigger a Digital Output for a light or other indicator. It is shown on Traqview as a red line.

To save the information in the Traqmate you must click on 'Save User Setup'.

Session Upload Screen

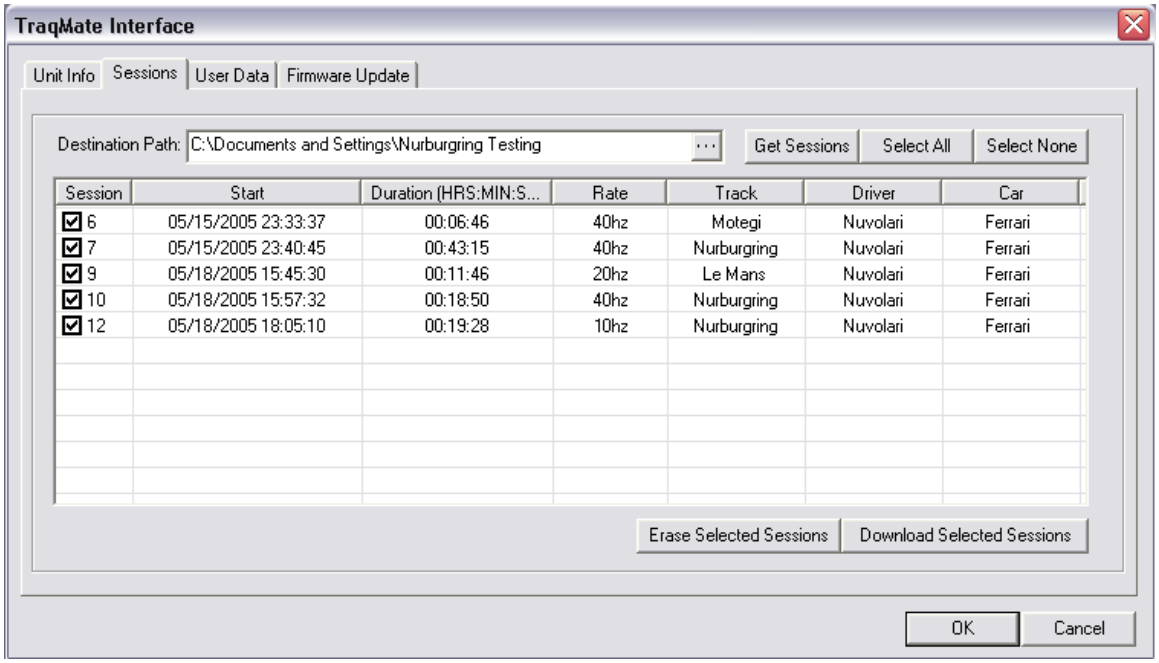


Figure 26 - Session Upload Screen

This screen will show all the sessions that are currently stored in the Traqmate. From this screen, you can upload the sessions to your PC or erase them. If you do not erase the sessions, they will stay in the unit.

The Session numbers are re-usable. If you erase session 1, the next session will be session 1 even though you may already have a session 2 and 3. The Start date will show the date that the session was recorded and length of time of the session. Rate is the Sampling Rate.

Note that if you are out of memory, if you erase Session 1 of 10, you will still be out of memory because Traqmate can only record data starting at the end. If you have this situation, use the Change Settings / Pack Memory function in the Display Unit to reclaim the memory.

Analysis Tools

Dashboard

Just as in your car, the dashboard is where you look to get information about what is going on with the vehicle and to change settings with that vehicle.

Within each driver frame it shows the current speed in MPH or KPH as a bar graph, whether the driver is accelerating (Green Dot), Constant Throttle (Grey Dot), or Braking (Red Dot). An outline of the Friction Circle is shown with the instantaneous G vector.

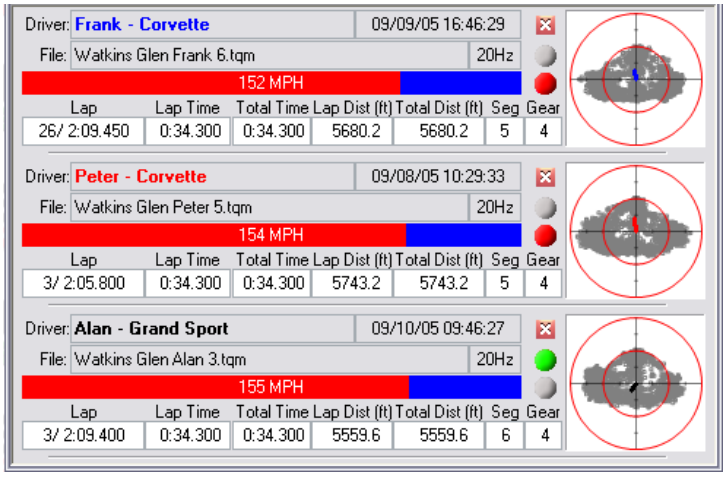

Driver: Frank - Corvette 09/09/05 16:46:29
File: Watkins Glen Frank 6.tqm 20Hz
152 MPH
Lap Lap Time Total Time Lap Dist (ft) Total Dist (ft) Seg Gear
26/ 2:09.450 0:34.300 0:34.300 5680.2 5680.2 5 4
Driver: Peter - Corvette 09/08/05 10:29:33
File: Watkins Glen Peter 5.tqm 20Hz
154 MPH
Lap Lap Time Total Time Lap Dist (ft) Total Dist (ft) Seg Gear
3/ 2:05.800 0:34.300 0:34.300 5743.2 5743.2 5 4
Driver: Alan - Grand Sport 09/10/05 09:46:27
File: Watkins Glen Alan 3.tqm 20Hz
155 MPH
Lap Lap Time Total Time Lap Dist (ft) Total Dist (ft) Seg Gear
3/ 2:09.400 0:34.300 0:34.300 5559.6 5559.6 6 4

Figure 27 - Dashboard

Other statistics are also shown:
Source file for each driver
Date and Time that data was recorded
Current Lap / Lap Time of the Total Lap
Lap Time to that point in the playback
Total Time into the session
Lap Distance to that point in the playback in Feet or Meters
Distance of the Total Lap in Feet or Meters
Segment number that the vehicle is within on the Track Map
Which Gear is selected at that point

Setup Screen

Selecting Forms and Adding Drivers to Graphs

To view a driver's information, you must add them to a Form. A form can be the Track Map, Brake and Turn Zone Map, Segment Analysis, and one or more Graphs. To do this, click Setup on the Dashboard window bar or in the Tools Menu. You will be presented the screen below. The left frame shows all the eligible forms (windows) where the data can be presented. Some drivers may have options not available to others depending on the inputs with which their Traqmate is equipped. Click the corresponding square to add that driver to a form. 'All' will add all eligible drivers to a form.

Selecting and Viewing Laps

The right frame shows each driver on a tab along the top and a list of all the laps that can be analyzed. The best lap is highlighted in green. 'All Laps' will add every complete lap to the selected forms while 'Best' will add only the fastest lap. 'All' will include all information including incomplete laps, and 'None' will remove all laps for that driver from the selected forms. You can compare multiple laps for a single driver (Best vs. Worst Lap, for example) by adding the same session twice.

If, for example, you select Lap 11 as the best lap for Driver A, and Lap 26 as the best lap for Driver B, and assign both to the Track Map and click OK, you will see both drivers queued up at the Start / Finish Line on the track. You can then use the Playback Controls to race the cars on that single lap or to follow their progress on one of the available graphs.

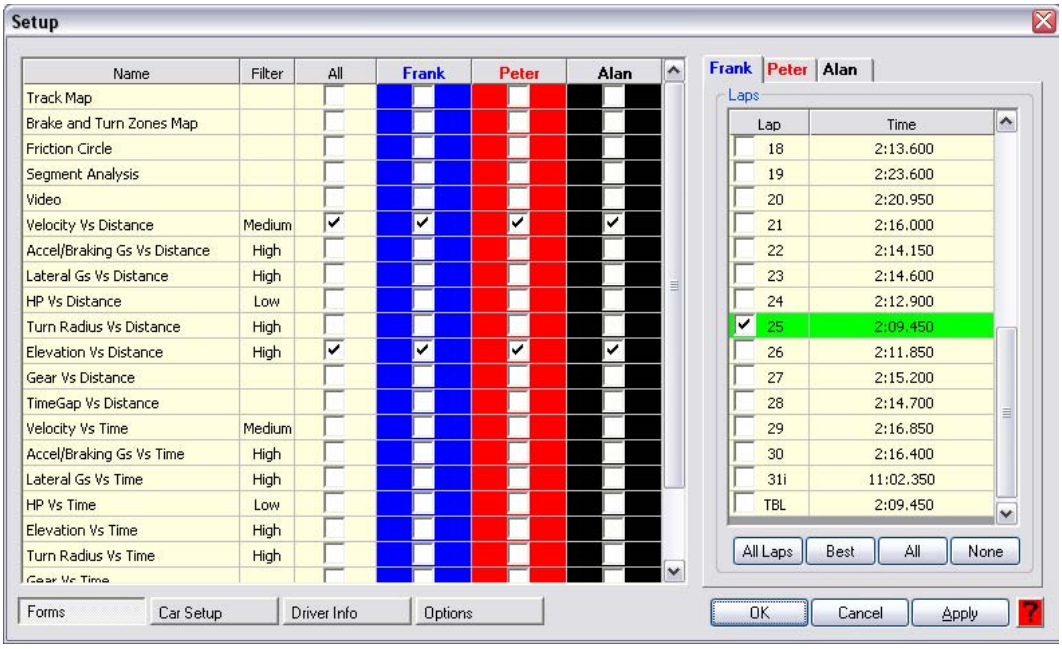


Figure 28 - Track Map, Graph and Form Setup

Theoretical Best Lap (TBL)

When one or more segments are created on the Track Map, Traqview will add up all the best segment times to calculate the Theoretical Best Lap for each driver. This appears as the last lap time in the list. If no segments are selected, the TBL will be equal to the best laptime.

If the driver were to execute each segment to the best of his/her proven ability, this is the laptime that would result. The calculations do not consider segment entry and exit speeds so this laptime is only theoretical but it does give an upper limit to shoot for and is therefore useful for comparison purposes. The TBL lap can be added as another driver and raced on the Track Map or graphed to compare with actual laps.

If you have TraqStudio, you can play back your Theoretical Best Lap as a sequence of video segments by selecting the TBL lap and hitting the Play button.

Video

The Video option is only presented if you are using TraqStudio. If enabled, you will be prompted for the location of the video file corresponding to that driver. If you are using the ChaseCam video recorder, this location could be a USB drive containing the compact flash card. It can also be a hard disk file or even a CD or DVD. When the file is successfully chosen, the video will appear as a window like any other form and will contain only the laps selected in the lap window for that driver.

Only one video for one driver may be selected. You can change the video file using the options on the video window or you may select a different driver for which to view synchronized video.

Getting Laps to Appear

Oftentimes, the laps will be listed as one very long lap until a Start / Finish Line location is chosen on the Track Map. If that is the case, select that long lap and then set the Start / Finish by drag and drop or by positioning the car icon on the track and pressing the Set Start/Finish button on the slider control panel. Once that occurs, the first lap and last lap including travel to / from the pit lane will be marked with an ‘i’ to designate an incomplete lap and usually should be left unselected.

Arranging Windows

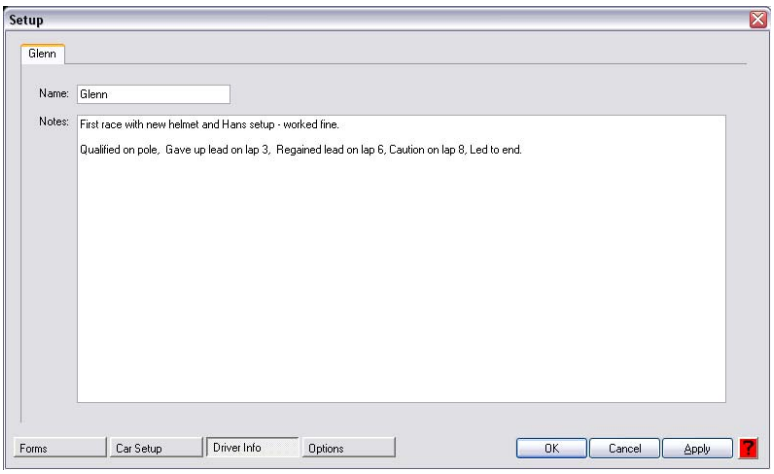
All of the Forms that are assigned to a driver will appear on the main window and may become cluttered. You can move them, resize them, or close them to suit your purposes. If a window becomes covered, use the Window menu entry to bring the window you wish to see to the top.

Filtering

The Filter Option allows you to apply a Low-Pass (Smoothing) Filter to many of the graphs. There are options for low, medium, and high level filters.

Changing Driver Name and Adding Notes

At the bottom of the Setup screen you will see a button for Driver Info. Using this option, you may change the name of a Driver and add any general free-form text that you would like about the session. This will be saved with an analysis file but will not change the information in the original data (.tqm) file.



Changing Vehicle Name and Adding Notes

At the bottom of the Setup screen you will see a button for Car Setup. Using this option, you may change the name of the Track and Car, enter the Gearing information used to calculate which gear is in use, enter the weight, drag and friction information for HP and Torque calculations, enter formatted information for Track Temperature, Tire Pressures, and enter general free-form text regarding the track or car. This will be saved with an analysis file but will not change the information in the original data (.tqm) file.

For a description of the gearing information, see the Gearing section **Gears** under Session Tools.

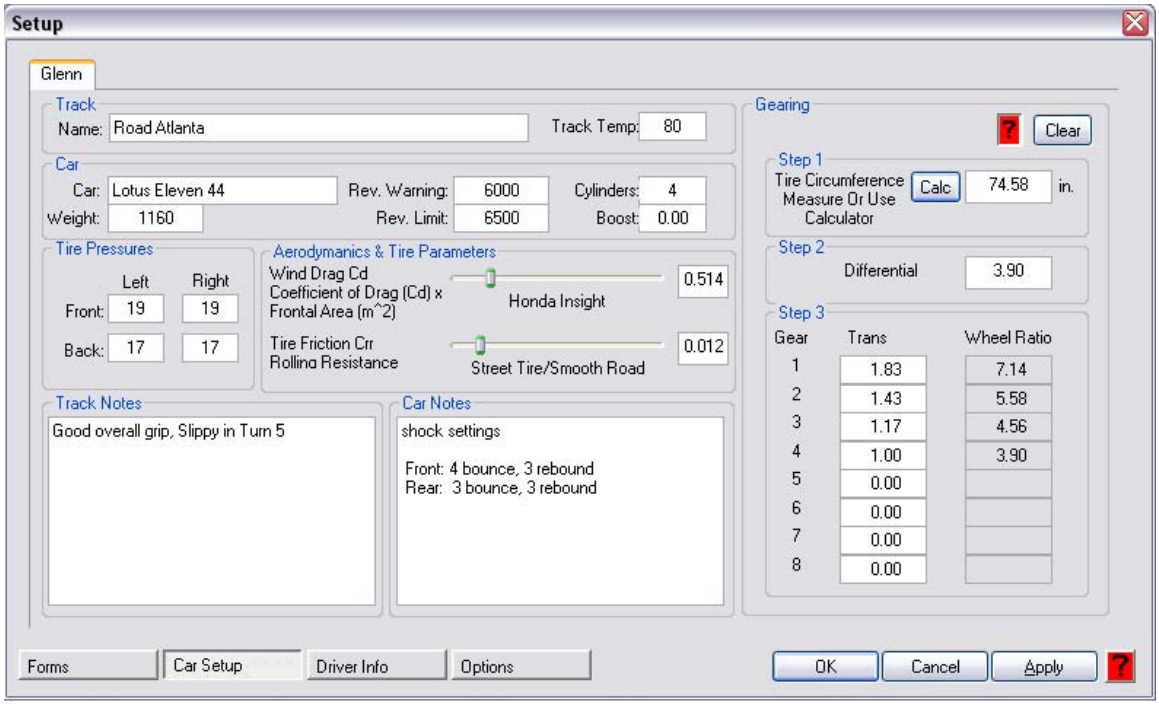


Figure 29 - Car Setup Screen

Playback Controls

To control the action of either data (vehicle(s) going around track) and/or video, use the VCR-style Playback Controls found at the bottom of the screen. Using these you can jump to the beginning or end of the selected laps, jump forward or backward 10 seconds, play at normal, reverse, fast, or slow speeds, and single step the data and/or video. In TraqStudio, you may mute the audio and control the volume. You may also use these controls to create segments or reset the Start/Finish line.

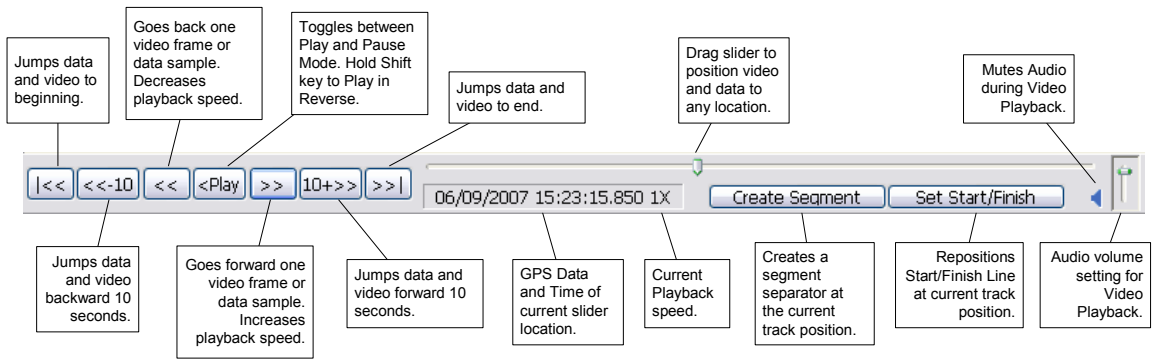

Jumps data and video to beginning.
Goes back one video frame or data sample. Decreases playback speed.
Toggles between Play and Pause Mode. Hold Shift key to Play in Reverse.
Jumps data and video to end.
Drag slider to position video and data to any location.
Mutes Audio during Video Playback.
|<< <<-10 << <Play >> 10+>> >>|
06/09/2007 15:23:15.850 1X
Create Segment
Set Start/Finish
Jumps data and video backward 10 seconds.
Goes forward one video frame or data sample. Increases playback speed.
Jumps data and video forward 10 seconds.
GPS Data and Time of current slider location.
Current Playback speed.
Creates a segment separator at the current track position.
Repositions Start/Finish Line at current track position.
Audio volume setting for Video Playback.

Figure 30 - Playback Controls

Track Map

The Track Map is the heart of the GPS Data Acquisition System. The Track Map will show one or more laps of up to eight vehicles. The vehicles will move around the track according to the Playback Controls in effect.

The Track Map is used to set the Start / Finish Line that is used to calculate the lap times shown in the Setup and Segment Screens. If you are using Traqmate Complete, the Start / Finish Line will transfer over if it was previously set in the Display Unit. In Traqmate Basic, you must set the Start / Finish line manually by grabbing the Start / Finish Icon (it will turn into a checkered flag) and dragging it to the new location. Alternatively, you can use the Playback Controls to position the Reference Vehicle and press the Set Start / Finish Button.

The Track Map is also used to create Segments separators. Click the Segment Tools button on the upper frame of the Track Map window to pop up the Segments tool menu. Drag the Segment Icon (bent arrow) onto the track near where you want the Segment separator. You can also use the Playback Controls to position the Reference Vehicle and press the Create Segment Button. The Auto-Create Segments button will create segments around the track for use in the Theoretical Best Lap calculation. You can drag the segments around to best suit your needs.

If the 'Highlight Segments' option is selected and segments are defined, each segment is shown in a pastel color. This color-coordinates with a header on the Distance Graph. The Track Map axis coordinates are in Feet or Meters.

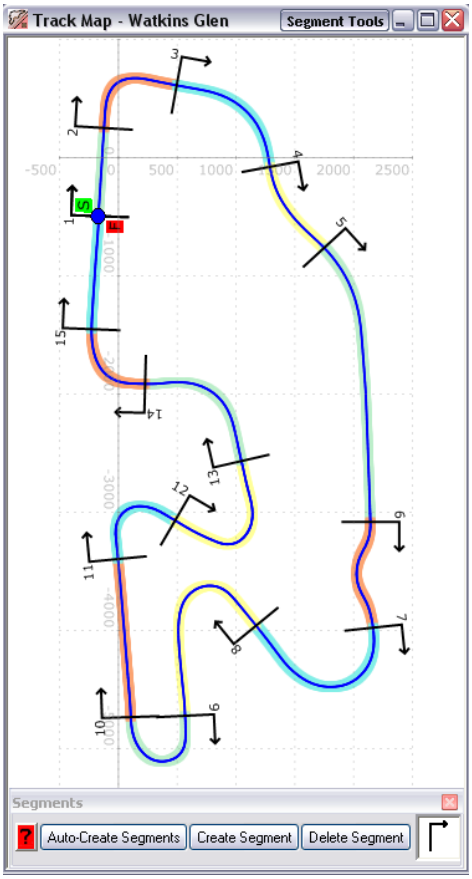


Figure 31 - Track Map

Track Facts

The Track Facts window shows some interesting information about the current track. This works for both closed circuits (circle track and road racing) and open circuits (rally and autocross). This is a great way to get the Start/Finish coordinates from previously recorded data in order to enter it into a Traqmate before returning to that track.

It also shows the Elevation changes over the track, the elevation at the Start and Finish, and the Track Length. Note that the length is the driving line, which is generally quite close to, the published track length, which is usually measured on the track centerline.

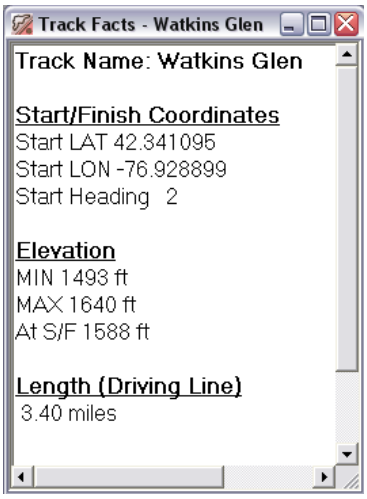


Figure 32 - Track Facts

Car Facts

The Car Facts window shows information about the vehicle that is associated with the recorded information. You can open a Car Facts window for each vehicle in an analysis.

This window is intended to allow you to have a historical record of how the vehicle was set up in order to duplicate that in the future or to "clone" another Traqmate for a similar vehicle.

This includes the scaling and naming values for the analog inputs and digital inputs, and the gearing information.

Other information shown includes the Rev Warning and Limits and the Number of Cylinders. This is the information required for the RPM input.

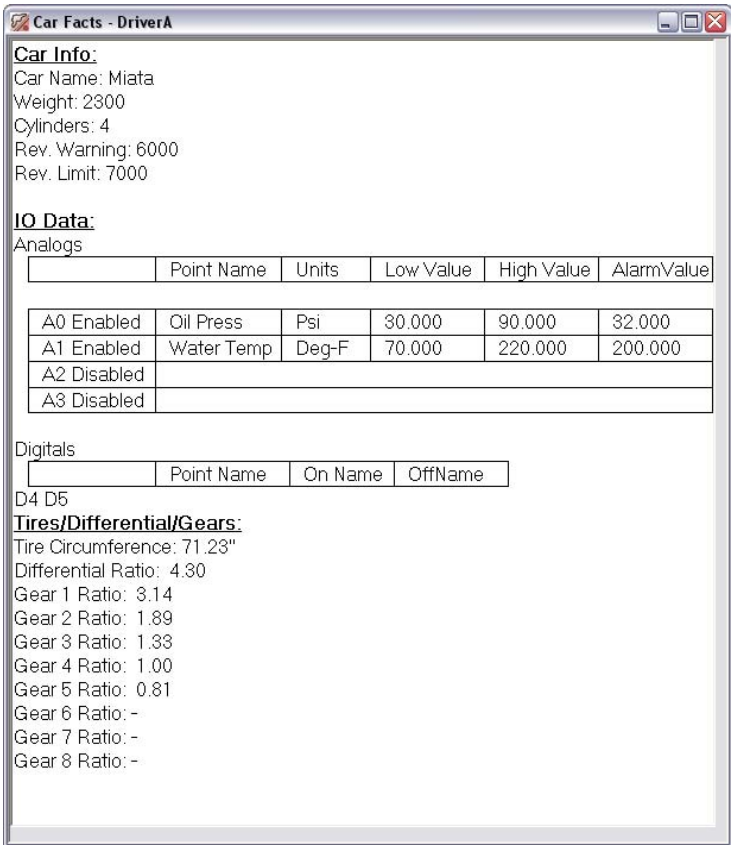

Car Facts - DriverA
Car Info:
Car Name: Miata
Weight: 2300
Cylinders: 4
Rev. Warning: 6000
Rev. Limit: 7000
IO Data:
Analogs
Point Name | Units | Low Value | High Value | AlarmValue
A0 Enabled | Oil Press | Psi | 30.000 | 90.000 | 32.000
A1 Enabled | Water Temp | Deg-F | 70.000 | 220.000 | 200.000
A2 Disabled
A3 Disabled
Digitals
Point Name | On Name | OffName
D4 D5
Tires/Differential/Gears:
Tire Circumference: 71.23"
Differential Ratio: 4.30
Gear 1 Ratio: 3.14
Gear 2 Ratio: 1.89
Gear 3 Ratio: 1.33
Gear 4 Ratio: 1.00
Gear 5 Ratio: 0.81
Gear 6 Ratio: -
Gear 7 Ratio: -
Gear 8 Ratio: -

Figure 33 - Car Facts

G vs. Time

The G vs. Time Graphs (Lateral and Accel/Braking) are just like the G vs. Distance Graphs (see below) only they are plotted over time instead of distance. Therefore, it is most useful for analyzing a single vehicle since two different laps will not match up on the time scale. If you select several laps they will be shown end-to-end so you can see a progression of the G levels obtained during a session.

G vs. Distance

The G vs. Distance Graphs (Lateral and Accel/Braking) show the G forces that are occurring at each place around the track. By playing back a lap and following the vehicle icon on the Track Map and the vehicle cursor on the G vs. Distance Graphs, you can see exactly what happened such as a touch of the brakes or a steering correction in the corner. This is a very useful graph for comparing two driving styles.

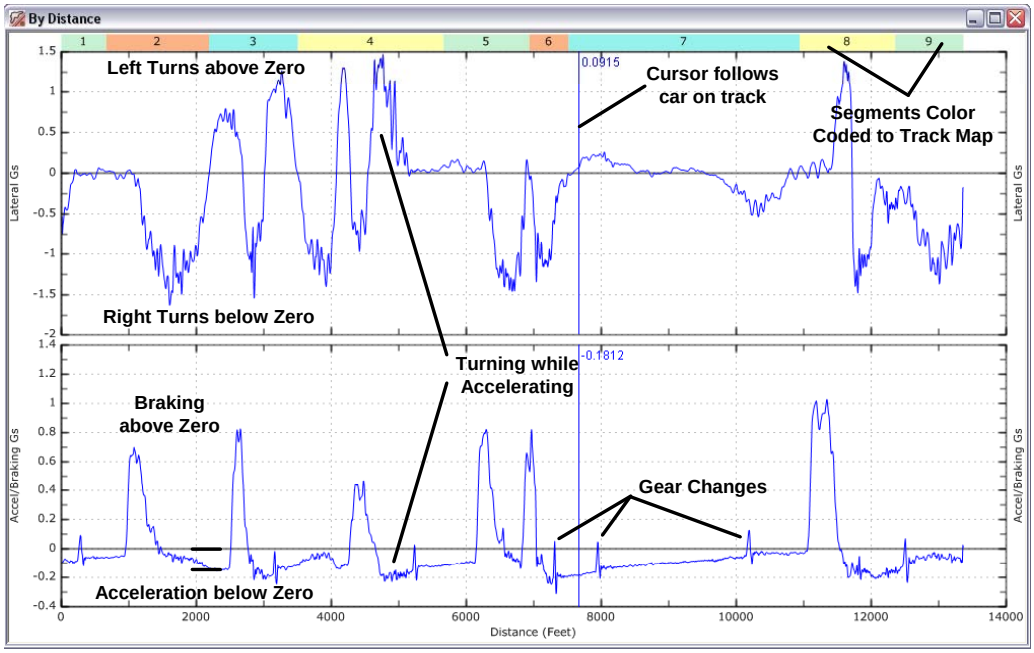


Figure 34 - G vs. Distance Graphs

Velocity vs. Time

The Velocity vs. Time Graph is just like the Velocity vs. Distance (see below) only it plots over time instead of distance. Therefore, it is most useful for analyzing a single vehicle since two different laps will not match up on the time scale. If you select several laps they will be shown end-to-end so you can see a progression of the speeds obtained during a session.

Velocity vs. Distance

Two of the most useful graphs for comparing two or more drivers or cars are the Velocity vs. Distance and Time Gap vs. Distance graphs. You can get an instant read on where a driver is carrying more speed through a turn, which car has the best top speed at the end of a long straightaway, and which car accelerates the best. It is easy to determine which trough is which turn by playing back the vehicle position on the Track Map and watching the cursor positions on the Velocity vs. Distance Graph.

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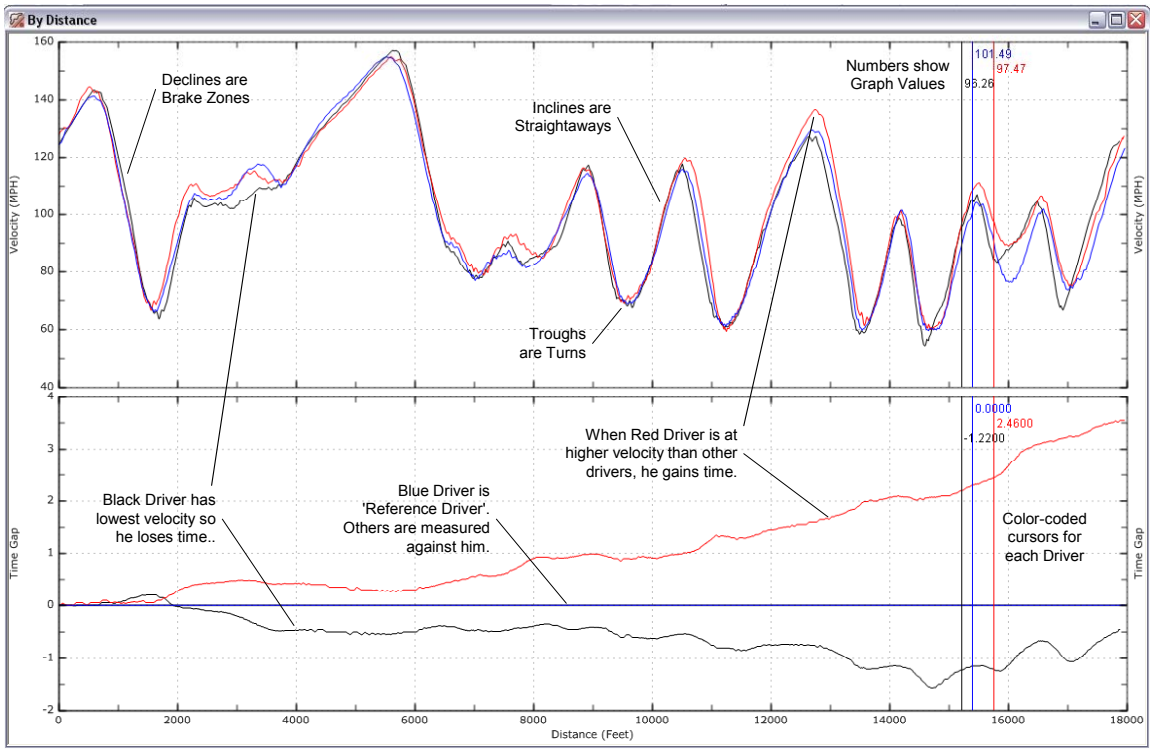

Figure 35 - Velocity and Time Gap vs. Distance Graphs

In the Velocity vs. Distance Graph, each driver's speed is shown as it occurred on the track. In this way, the peaks and valleys align so you can see obvious gaps in carrying speed through turns and acceleration differences (slope of the curve) on the straightaways.

Time Gap vs. Distance

The Time Gap vs. Distance Graph is conceptually difficult but extremely useful. This graph shows where one driver is gaining or losing time as he moves around the racetrack in comparison to another driver or another of his own laps. While distance gaps may expand and contract depending on where each driver is in his braking and acceleration zones, the time between the drivers is ultimately the measure of their relative performances.

In this graph, if the line for a particular driver is going up, he is gaining time on the reference driver. If it is declining, he is losing time to the reference driver. The gap between the two lines at the end of the lap is the difference in lap times between the two drivers.

Horsepower and Torque

Traqview / TraqStudio gives you two ways to view the horsepower and torque values as the vehicle goes around the track; by graph, and numerically using the Segment Analysis.

Horsepower is calculated from the acceleration, vehicle weight, aerodynamic drag, and rolling resistance. Torque is derived from the horsepower and RPM. Both values have been calibrated to reflect the entire driveline and should be consistent with testing done at a rolling drum dynamometer. Both must be used carefully to get valid results. To be valid, all of these conditions must be met:

- Reading must be chosen at a level place on the track where the vehicle is going straight. You can use the Elevation and Lateral G graphs to help choose a measurement location.
- Reading must be chosen on a lap where the vehicle is neither drafting nor being drafted.
- Wind resistance (Drag x Frontal Area) must be set correctly.

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- Tire rolling resistance must be set correctly for the type of tire and surface.
- No head winds or tail winds.
- Traqmate must be mounted very level in car (within .02 G).
- Driver was full throttle.
- Engine RPM is in the appropriate range for both peak HP and/or torque.

Once a proper lap and track location is identified, it is recommended that a small segment be created around that location and the Average HP and Torque be used across that segment to get a sustained hp number. Note that Peak Torque is generally not achieved at the same location as Peak HP so separate track locations may have to be chosen for each.

In this example, peak horsepower (116) is achieved at maximum RPM but peak torque is achieved earlier in the rev range.

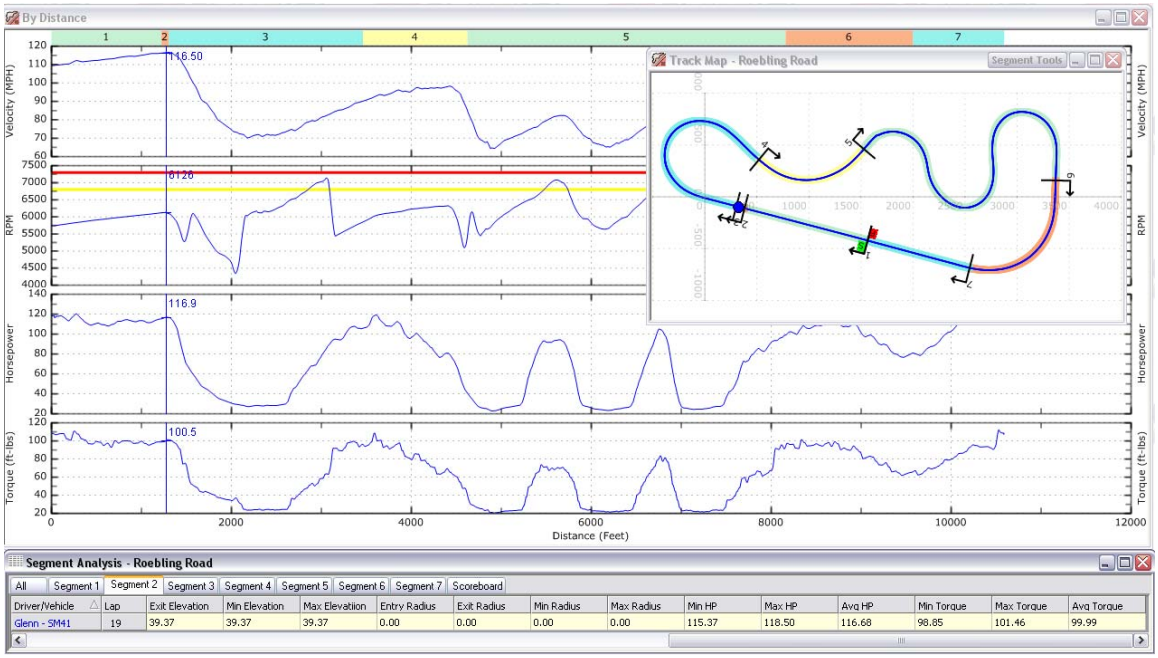

Figure 36 - Horsepower and Torque Graph

Elevation

One aspect of track analysis is the absolute elevation and the elevation change. Vehicle performance changes with altitude so the general elevation of a track is important. With the elevation information, it is possible to compensate for changes in air density with carburetor jetting, air/fuel meter settings, or ECU fuel maps.

When driving a track, the change in elevation is important. For example, acceleration increases when going downhill and grip increases if a turn goes uphill. While driving, it is not always apparent which parts of the track are slightly up or downhill so Traqview provides a tool to help you visualize the elevation changes around a track.

You can plot the elevation over time or distance and the Segment Analysis will show the Entry and Exit Elevations for each segment. In this example, we learn that the front straight at Road Atlanta (Segment 1) drops by 28 feet in elevation.

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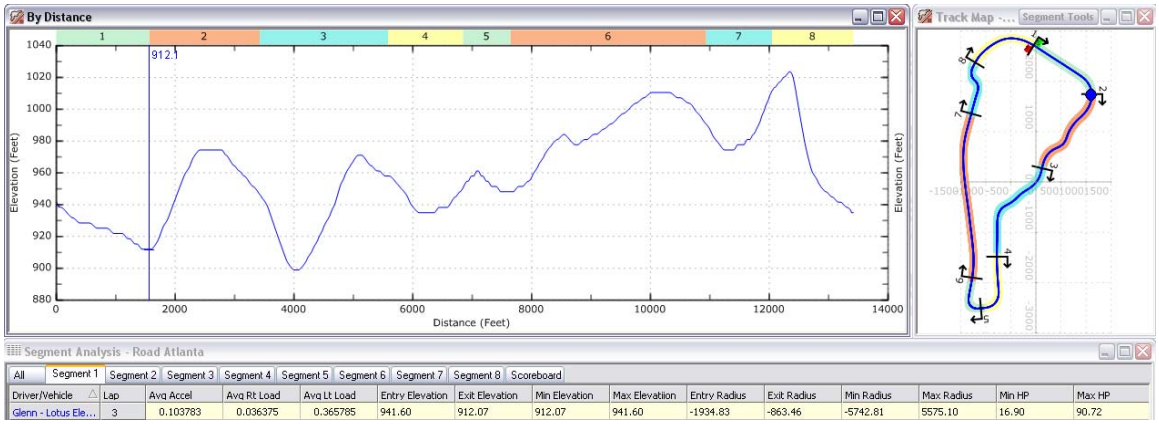


Figure 37 - Elevation Graph

Track Turn Radius

Another aspect of track analysis is the radius of the turns and any changes in radius within the turn. Increasing radius turns allow the vehicle to accelerate through the turn while decreasing radius turns allow a faster entry and patience on the throttle. Subtle changes in radius are not always apparent from the driver seat until you run out of asphalt. Traqmate uses accelerometer technology to constantly monitor the direction of the vehicle and the tightness of the turns. This can be especially useful to overlay two drivers to compare the approaches to a turn or a sequence of turns. It can reveal if a driver is pinching off a turn or turning in too early.

Note that negative values are right-hand turns and positive values are left-hand turn and the values in this graph are only valid when in a turn. When on a straight, the turn radius gets very large and is pegged to zero.

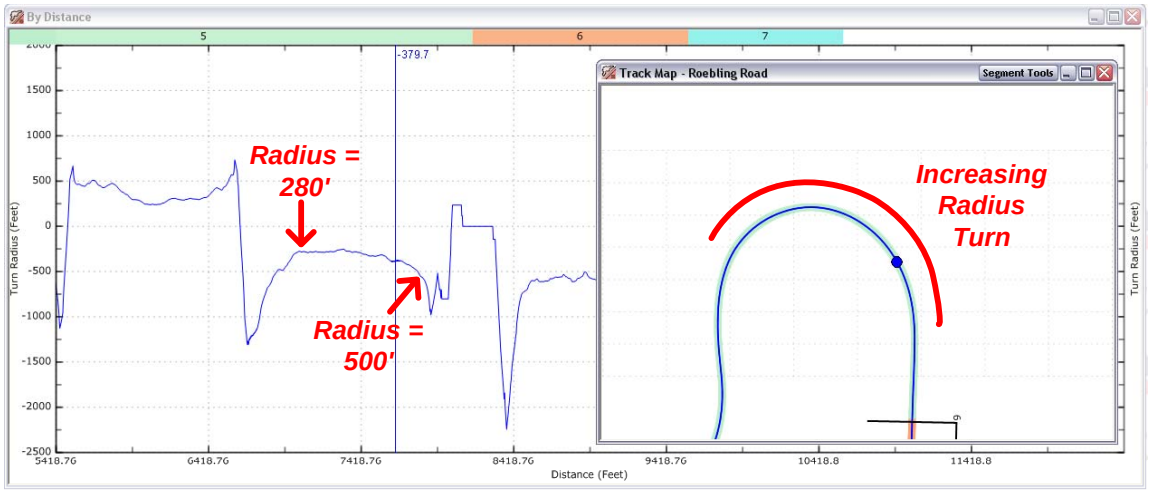
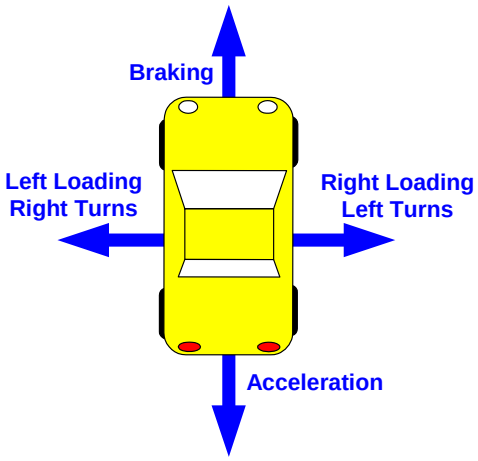


Figure 38 - Turn Radius Graph

Friction Circle

The Friction Circle graph shows the forces acting on the vehicle in the forward, reverse, left, and right sides, plotted on an X-Y Graph where the vertical axis is Braking/Acceleration and the horizontal axis is Left/Right Loading. For most vehicles, the shape of the Friction Circle graph will be an inverted triangle. The reason for this is that most vehicles stop much better than they accelerate so more forces will be generated in that direction.



This graph is used to gauge the overall amount of performance available in the car and the amount of that capability the driver is using. Especially of interest are the transitions from braking to turning to acceleration. By watching the cursor move around the graph during playback, you can see the transitions. It is useful to picture the car from overhead as in the diagram and think of the cursor as the top of the driver's helmet.

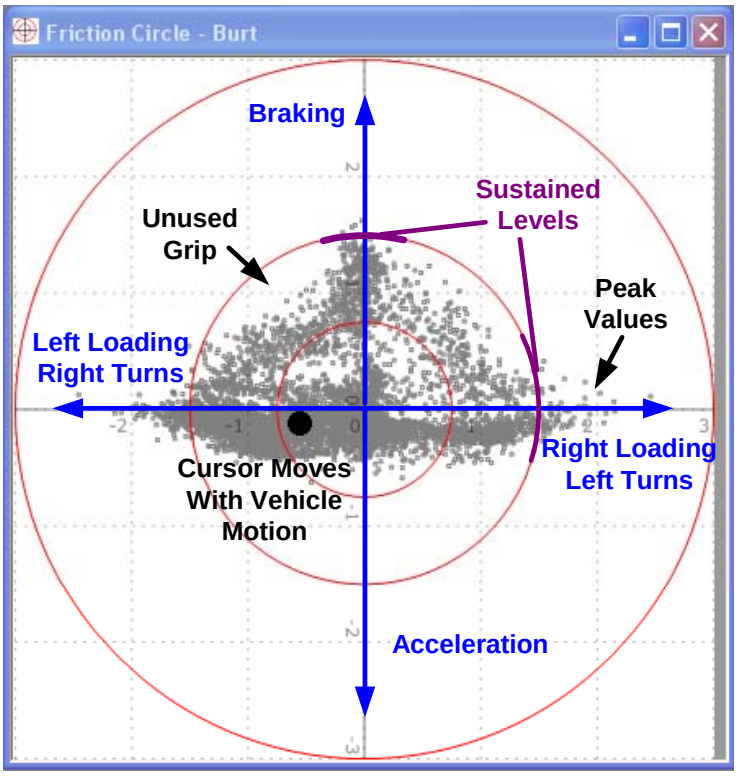


Figure 39 - Friction Circle Graph

Note that the Friction Circle shows peak loads. A tire near maximum grip level is constantly gripping and releasing the pavement. In addition, a hard turn-in will generate instantaneous loads that are not sustainable. The extremely sensitive accelerometers will pick this up, creating peaks in the data. While these are real, the actual sustained level of grip that can be measured on a skidpad is somewhat lower.

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Braking and Acceleration Zones

The Brake and Turn Zone Map shows the forward/reverse and lateral forces acting on the vehicle and where they occur on the track. This map will show what a driver is actually doing on the track. All actions are color-coded. Braking is red, Acceleration is green, Coasting is black. Left Turns are yellow, Right Turns are blue. Combinations of turning and braking or acceleration produce mixed colors as shown in the chart.

You can enable or disable either Braking/Acceleration Zones or Turn Zones or both. You can also adjust the thresholds for determining what is acceleration vs. coasting for example. This can often reveal more detail such as where a driver is still accelerating but not full throttle or where a car is scrubbing speed.

Enabling only Braking/Acceleration will reveal areas of coasting, transition time from brake to throttle and back, and shift points are shown as small black marks.

Enabling the Turn Zones only will show turn-in and turn-out points. Tentative or “fuzzy” transition from straight to turn-in can reveal vehicle understeer.

Enabling both Braking/Acceleration Zones and Turn Zones will reveal techniques such as lifting in a turn to orient the vehicle or trail braking.

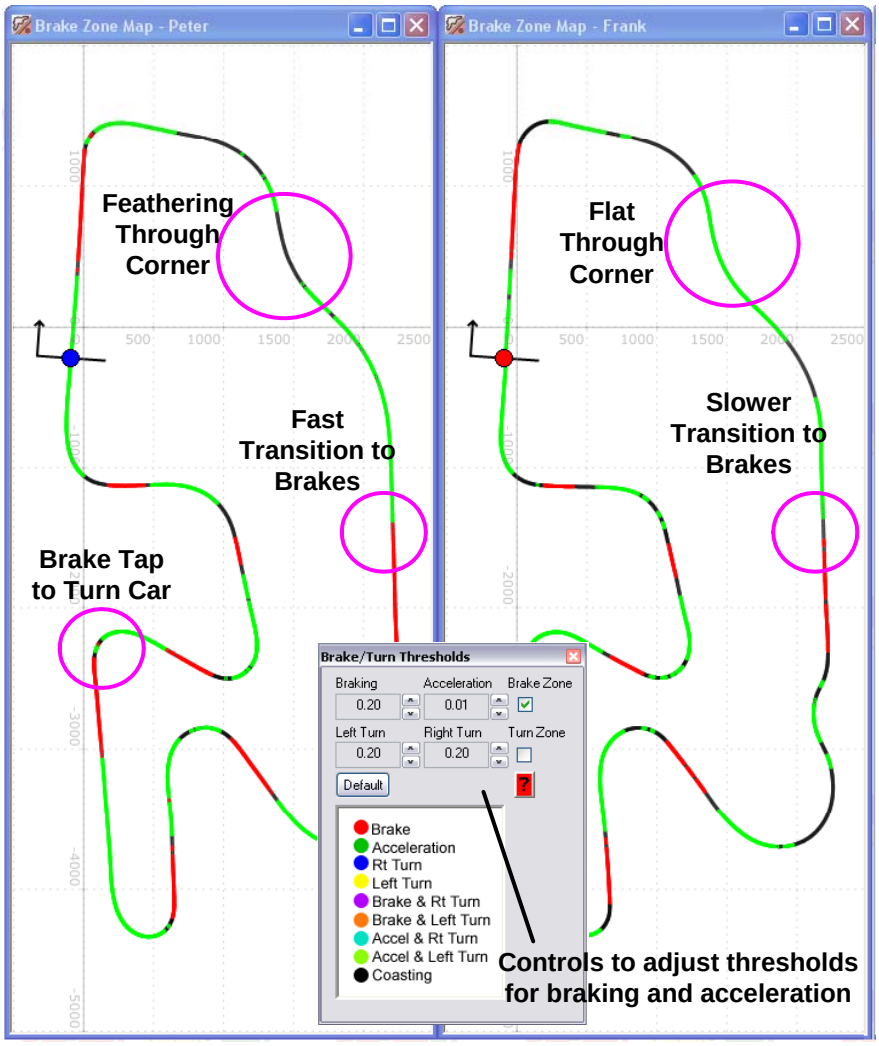
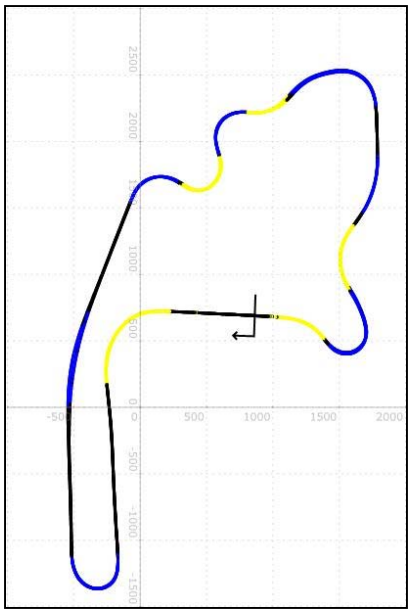


Figure 40 - Brake Zone Map

Turn Zones



The Turn Zone Map shows the lateral forces acting on the vehicle and where they occur on the track. This graph is primarily used to show turn in and turn out points. When combined with the brake zone map you can see trail braking and where the acceleration is applied during the turn.

Enable the Turn Zones with the enable control on the Brake and Turn Zone map. Use the Turn Zone threshold adjustments to tune the map to your particular car and reveal hidden information.

Right turns are shown as dark blue and left turns are shown as yellow. Black is shown where the vehicle is traveling mostly straight.

You can use these transition points to set up segments on a reference lap, save as a .tqs file, and then add laps to it later to see if speed has been gained or lost in a particular set of turns.

When you enable Turn Zones and Brake Zones at the same time, you get a combination of colors. While the "rainbow map" may seem confusing at first, there is a lot of useful information contained in those colors.

For example, braking is Red and right turns are Blue. If you see a Purple segment that shows the driver was braking and turning right at the same time (i.e., trail braking).

Similarly, Orange indicates trail braking into a left turn. Chartreuse and Turquoise show turning while accelerating, which can reveal where the throttle is applied during a turn.

Experiment with the thresholds to reveal even more information.

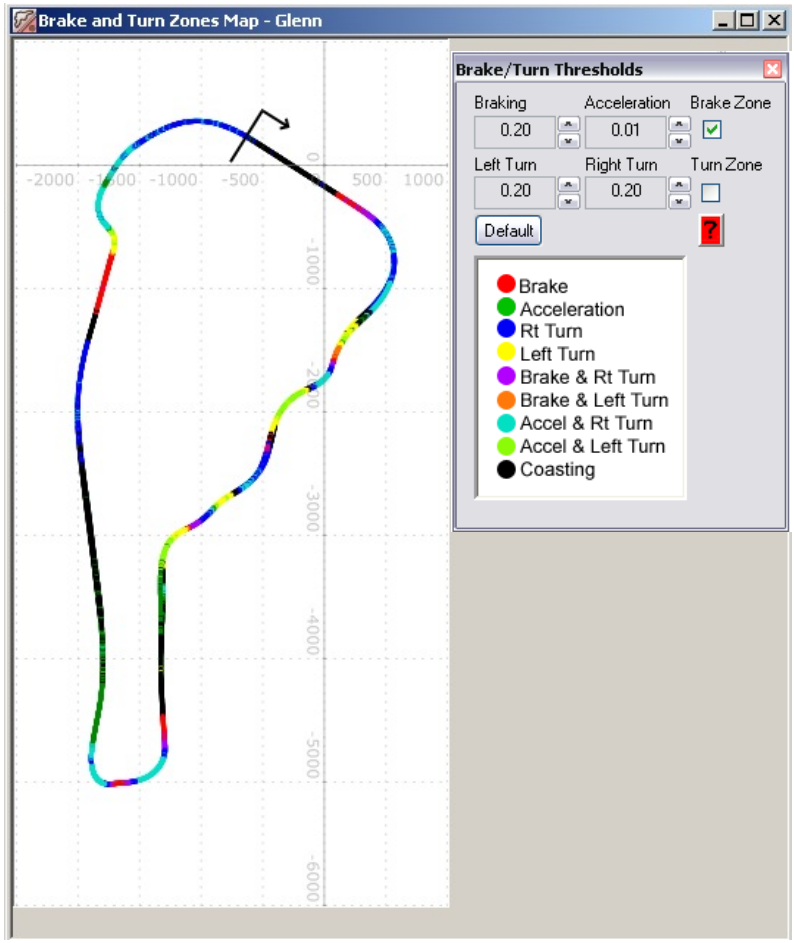


Figure 41 - Turn Zone Map

Segment Analysis

One of the most powerful features of Traqview is Segment Analysis. This allows you to compare two small sections of the track on several laps. This is especially useful for comparing two drivers who might take different approaches to a corner or for doing a before/after comparison of a new technique or driving line.

Segment separators are used to divide the track up into segments. Starting with Traqview V2.0, segments are contiguous; the next segment always begins where the previous segment ends. Older analysis files can be imported but some adjustment may be necessary.

Traqview has a default Segment "All" that is the entire lap. To look at a particular section of the track, you must create one or more segments. Click the Segment Tools button on the upper frame of the Track Map window to pop up the Segments tool menu. Drag the Segment Icon (bent arrow) onto the track near where you want the Segment separator. You can also use the Playback Controls to position the Reference Vehicle and press the Set Create Segment Button. The Auto-Create Segments button will create segments around the track for use in the Theoretical Best Lap calculation. You can drag the segments around to best suit your needs. To delete a segment separator, drag the icon off the track.

If the 'Highlight Segments' option is selected, each segment is shown in a pastel color. You can zoom into the track map to see more detail about the segment. When a driver enters a segment, the number is shown on his/her portion of the dashboard.

Add drivers to the Segment Analysis Table using the 'Setup' button on the dashboard. Note that every lap selected for each driver is included in the table.

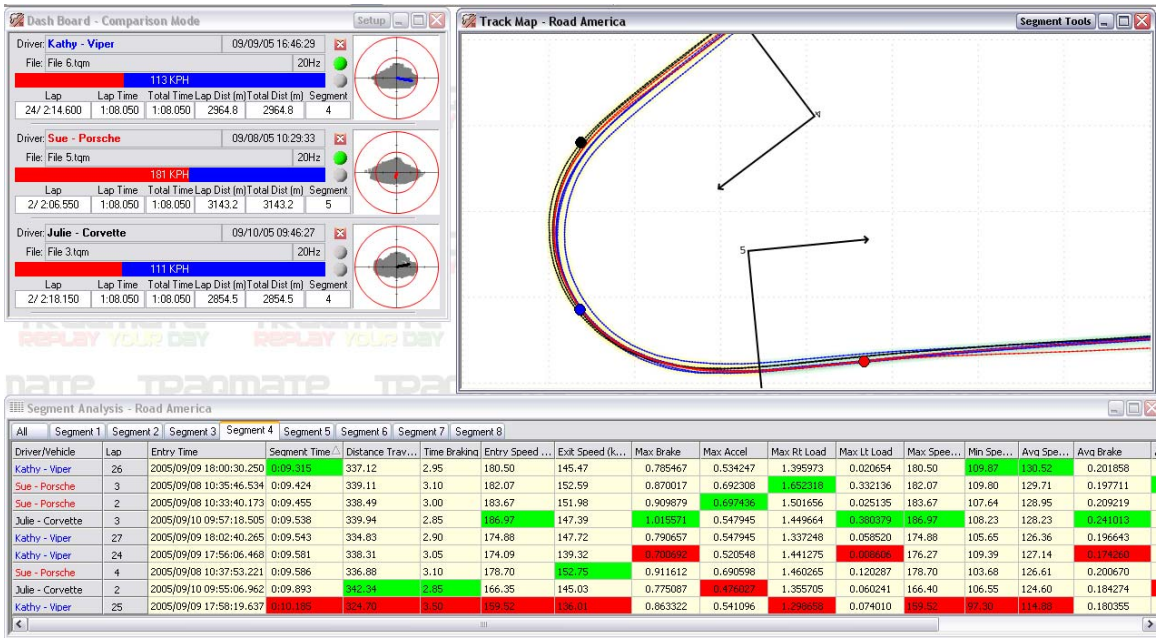


Figure 42 - Segment Analysis Table

Each time you create a segment, another table is added to the Segment Analysis Table Screen. You access each table by clicking on the tabs at the top of the Segment Analysis window. Each table shows the time required for the vehicle to traverse the segment, entry and exit speeds and many more parameters (listed below).

By clicking on a column in the table, the entire table will be sorted by the values in that column. For example, to see the maximum exit speed, click on the Exit Speed column heading. Click on it

again and it will be sorted in the reverse order. In each column, the minimum performance value is highlighted in red while the maximum performance value is highlighted in green.

Exporting Segment Data

If you wish to do further analysis or print a list of your laptimes, the Segment Analysis information can be exported to a Microsoft Excel-compatible .CSV text file. Highlight the Segment Analysis window and select File / Export Graph/Form.

Segment Analysis Data Columns

Driver/Vehicle – Shows from which driver and vehicle the row data was collected
Lap – Which lap the row data was collected
Entry Time – Exact local time that the segment started
Segment Time – Length of time to traverse the segment (seconds)
Distance Traveled – Distance traveled in the segment (feet or meters)
Time Braking – The amount of time on the brakes during the segment (seconds)
Entry Speed – Speed at start of segment (MPH or KPH)
Exit Speed – Speed at end of segment (MPH or KPH)
Max Brake – Maximum braking force during the segment (Gs)
Max Accel – Maximum acceleration force during the segment (Gs)
Max Rt Load – Maximum Right Side (left turn) lateral force during the segment (Gs)
Max Lt Load – Maximum Left Side (right turn) lateral force during the segment (Gs)
Max Speed – Maximum speed during the segment (MPH or KPH)
Min Speed – Minimum speed during the segment (MPH or KPH)
Avg Speed – Average speed throughout the segment (MPH or KPH)
Avg Brake – Average braking force applied throughout the segment (Gs)
Avg Accel – Average acceleration throughout the segment (Gs)
Avg Rt Load – Average Right Side (left turn) lateral force during the segment (Gs)
Avg Lt Load – Average Left Side (right turn) lateral force during the segment (Gs)
Entry Elevation – Elevation at start of segment (feet or meters)
Exit Elevation – Elevation at end of segment (feet or meters)
Min Elevation – Lowest elevation in segment (feet or meters)
Max Elevation – Highest elevation in segment (feet or meters)
Entry Radius – Curve radius at start of segment (feet or meters)
Exit Radius – Curve radius at end of segment (feet or meters)
Min Radius – Smallest curve radius in segment (feet or meters)
Max Radius – Largest curve radius in segment (feet or meters)
Min HP – Lowest calculated horsepower in segment (BHP)
Max HP – Highest calculated horsepower in segment (BHP)
Avg HP – Average horsepower across segment (BHP)
Min Torque – Lowest calculated torque in segment (lb-ft or N-m)
Max Torque – Highest calculated torque in segment (lb-ft or N-m)
Avg Torque – Average calculated torque across segment (lb-ft or N-m)

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Segment Analysis Scoreboard

The last tab on the Segment Analysis window is Scoreboard. This is very useful if you have several racers that you are comparing. It will show you at a glance who has the fastest segment times all over the track. This is similar to the on-screen scoreboards used by racing announcers while calling qualifying or races. “Räikkönen just set the fastest time in Sector 2”.

You can sort by any of the segments by clicking on the column heading to show the fastest or slowest segment times for all the drivers. In this example, Segment 7 has been selected and sorted fastest to slowest. This is indicated by the upward arrow on the ‘7’ column heading.

Driver/Vehicle	Lap	All	1	2	3	4	5	6	7	8	9	10
Glenn - SM41	TBL	1:45.611	0:06.415	0:08.597	0:11.133	0:13.505	0:07.211	0:05.509	0:09.412	0:23.599	0:10.898	0:09.328
JK - CMS TR3	TBL	1:54.250	0:07.015	0:09.820	0:12.588	0:15.071	0:07.481	0:06.039	0:09.472	0:23.842	0:12.267	0:10.651
Glenn - SM41	14	1:47.988	0:06.584	0:08.604	0:11.370	0:13.551	0:07.236	0:05.662	0:09.541	0:23.851	0:11.802	0:09.784
Mark - SM 41	TBL	1:46.373	0:06.539	0:08.589	0:11.175	0:13.396	0:07.254	0:05.519	0:09.543	0:23.947	0:10.973	0:09.436
Glenn - SM41	17	1:47.132	0:06.543	0:08.715	0:11.254	0:13.536	0:07.292	0:05.579	0:09.559	0:23.973	0:11.223	0:09.455
JK - CMS TR3	8	1:55.247	0:07.100	0:09.820	0:12.588	0:15.234	0:07.598	0:06.162	0:09.565	0:23.867	0:12.350	0:10.960
JK - CMS TR3	5	1:54.971	0:07.227	0:09.825	0:12.639	0:15.142	0:07.567	0:06.039	0:09.592	0:24.019	0:12.267	0:10.651
Thomas - Viper	TBL	1:52.640	0:06.830	0:09.171	0:11.955	0:14.651	0:07.755	0:05.785	0:09.660	0:25.285	0:11.461	0:10.082
Thomas - Viper	16	1:53.380	0:06.859	0:09.329	0:12.072	0:14.651	0:07.789	0:05.785	0:09.746	0:25.415	0:11.559	0:10.170
Thomas - Viper	11	1:53.925	0:06.858	0:09.171	0:12.714	0:14.727	0:07.857	0:05.920	0:09.784	0:25.285	0:11.523	0:10.082
Mark - SM 41	5	1:48.342	0:06.576	0:08.589	0:11.460	0:14.044	0:07.381	0:05.787	0:09.800	0:24.050	0:11.017	0:09.635
Mark - SM 41	6	1:47.054	0:06.652	0:08.631	0:11.268	0:13.396	0:07.320	0:05.519	0:09.856	0:23.947	0:10.973	0:09.487

Figure 43 - Segment Analysis Scoreboard

Separate Start / Finish (Rally) Mode

The default operation of Traqview is Circuit Mode where the Start and Finish Lines are the same. You can also analyze data from open circuit events such as Autocross, Rally Stages, and Hillclimbs. If you record the data in Autocross or Segment Timing mode, the data will automatically appear in Separate Start/Finish line (Rally) mode and the start and finish lines will transfer over from the Display Unit. Of course, you can also change the Start and Finish lines in Traqview or set them in the case of a Traqmate Basic.

To enter Rally Mode, press the icon shown with the yellow closed circuit track. It will change to the open circuit icon. To change back, press the open circuit icon.

Almost any analysis that can be performed in Circuit Mode can also be done in Rally Mode, such as Velocity vs. Distance, Segment Analysis, Brake and Turn Zone Maps, and Friction Circle as shown below.

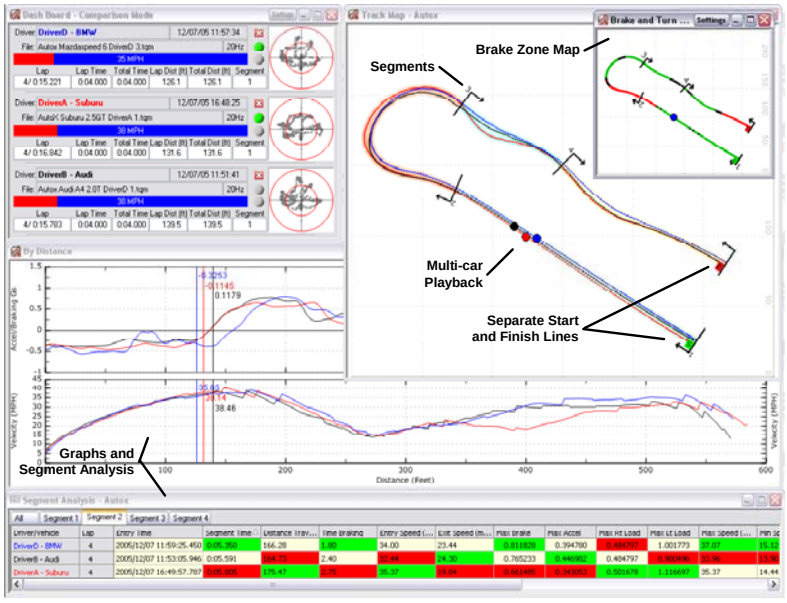
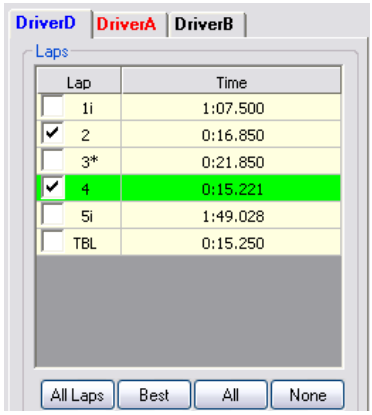


Figure 44 - Autocross / Rally Mode

When you enter Rally Mode you are no longer working with complete laps but with sections of laps. If there is data connecting segments that are contained within the Start and Finish Lines, it is marked in the lap list with an asterisk. Generally, you would not select that data for analysis.

This example shows a run of 16.850 seconds and another run of 15.221 seconds connected by a staging time of 21.850 seconds.



Session Tools

Swap Axis

Sometimes it is more convenient to mount a Traqmate facing in the wrong direction. Swap Axis allows the data to be adjusted for the orientation of the Traqmate.

If data was collected with the unit pointed to rear of car, swap both X and Y axes.

If data was collected with the unit mounted sideways in car, rotate 90 degrees until data correct. If unit was mounted upside down, swap the Y axis.

If unit was upside down and pointed to rear, swap the X axis.

You may save the new orientation as a .tqs file.

Time Zone

Sometimes the user forgets to set the time zone in the Traqmate so that recorded data shows up with the wrong time. This can be corrected for each driver using the Time Zone utility. This is very useful when replaying a race (see Race Replay Mode) where one of the drivers has a different time zone setting.

Align Sessions

Occasionally when you compare two sessions that were recorded some time apart, the track maps will not align perfectly. This is due to the slow drift of GPS over time or possibly due to different antenna placements on the vehicles. Session align allows the path for the selected session to be adjusted to bring it back into perfect alignment.

Choose a driver and use the arrow keys to move the path in the desired direction. The path is moved by the number of feet specified in the field between the arrow keys.

You may save the realigned analysis as a .tqs file.

Trim Sessions

Trim allows unnecessary data at the beginning or end of a session to be trimmed.

To remove data at the beginning of the session, first move the position of the car (using the slider and forward/reverse arrows) to the desired starting point and click 'Trim Start'.

To remove data at the end of the session, move the position of the car to the desired ending point and click 'Trim End'.

To restore all the vehicle data click 'Undo'.

You may save the trimmed data set as a .tqs file.

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Gears

For Traqview to display the gear on either the Data or Video Dashboard or in the Gear Graph, you must have a working RPM input and either select the gear based on what point you are on the track OR enter the Tire Size and Final Drive Ratios. The first method is best if you already have data collected. The second is best if you are setting up the Traqmate before data collection.

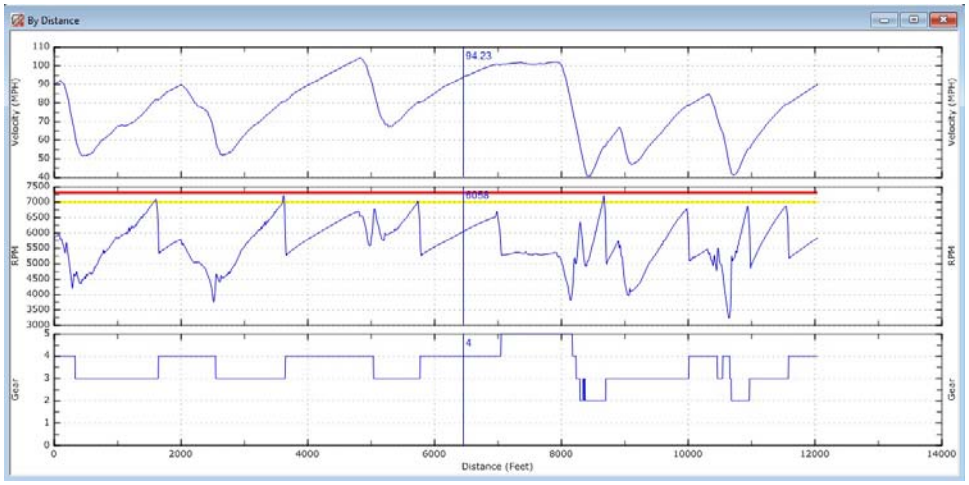


Figure 45 - Gear by Distance Graph

To select the gears based on position on the track, use the slider control to position the car to a point on the track where you know which gear you were in, then click the radio button of the matching gear. (i.e. select 5th when you are in 5th on a straight and select 2nd when you are exiting a corner in 2nd gear). To help pick the right spot, select only one lap and use the RPM vs Time graph along with the track map. For an accurate selection, it is best to select when the car is going straight and the clutch is fully engaged. Select all the gears, click 'Apply' to update the session data. The gearing information may be stored with the data in an analysis (.tqs) file.

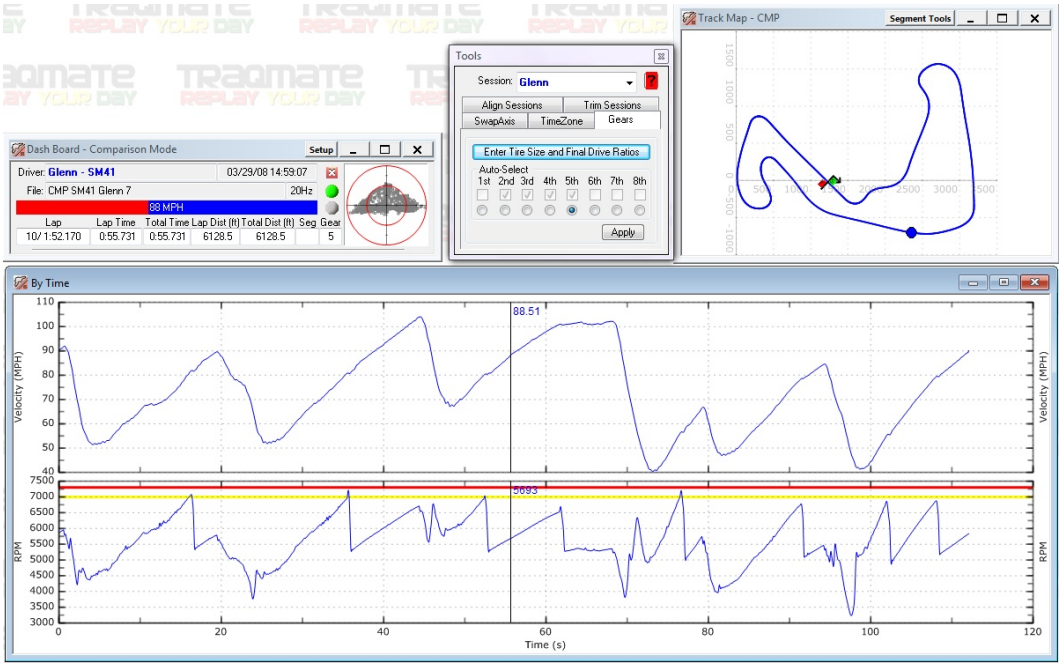


Figure 46 - Setting Gears using Track Position

If you choose to 'Enter Tire Size and Final Drive Ratio' you will need the tire circumference (either use the tire size calculator OR measure the tire), the ratio of the differential, and the ratios for each of the transmission gears. Often this information can be found online or through the manufacturer's booklet. Click 'Apply' to update the session data.

TIRE SIZE

In order to determine which gear is selected in the vehicle, the circumference (distance around) the tire must be calculated. The vehicle travels this distance for every revolution of the tire.

You may enter the numbers on the sidewall of the tire and Traqview will calculate this for you or you can measure the distance around the tire with a tape measure. Most tire circumferences are in the range of 50 in (127 cm) to 150 in (381 cm).

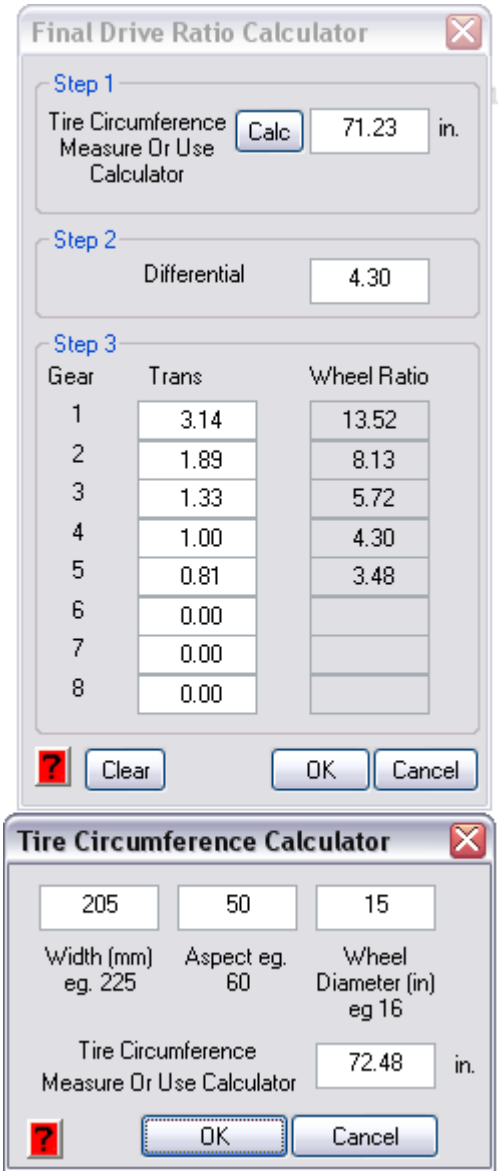
GEARING

In order to determine which gear is selected in the vehicle, the differential and gear ratios must be entered.

The Differential Ratio is the number of times the driveshaft (differential input) rotates for each rotation of the wheels (differential output). This number is generally between 2.0 and 5.0.

The Transmission Ratios are the number of times the engine (transmission input) rotates for each rotation of the driveshaft (transmission output) in each gear. This information should be available from your vehicle or transmission manufacturer. Leave extra spaces blank. Generally, these numbers fall in the range of and 5.0 and 0.4.

The Wheel Ratio is the number of times the engine rotates for each rotation of the tire in each gear. Each ratio is the respective transmission gear ratio multiplied by the differential ratio. Leave extra gear spaces blank. Generally, these numbers fall in the range of 1.0 to 20.0.



Race Replay Mode

The default operation of Traqview is Comparison Mode. In Comparison Mode you can overlay drivers and laps that were recorded at any time and “race” them against each other by aligning them both at the Start/Finish. That works very well and is the best choice for actually comparing the performance of car and/or driver.

However, consider the case of a race with many participants. Not all cars cross the start at the same time so to actually replay the race you need to show the exact location of each vehicle at the same point in time. This is also very useful for rallies with staggered starts to show the actual position of cars on the road. That is why Race Replay Mode was created.

To enter Race Replay Mode, you must have sessions loaded with overlapping Start and End times. If you wish to adjust the start times, use the Time Zone tool. To activate, press the icon shown with the magnifying class. It will change to the icon with the checkered flag. To re-enter Comparison Mode, press the checkered flag icon.

When you enter Race Replay Mode, you are no longer working with laps but rather a period of time. The Setup screen will present another option called Race Setup. Select that tab to choose the race period.

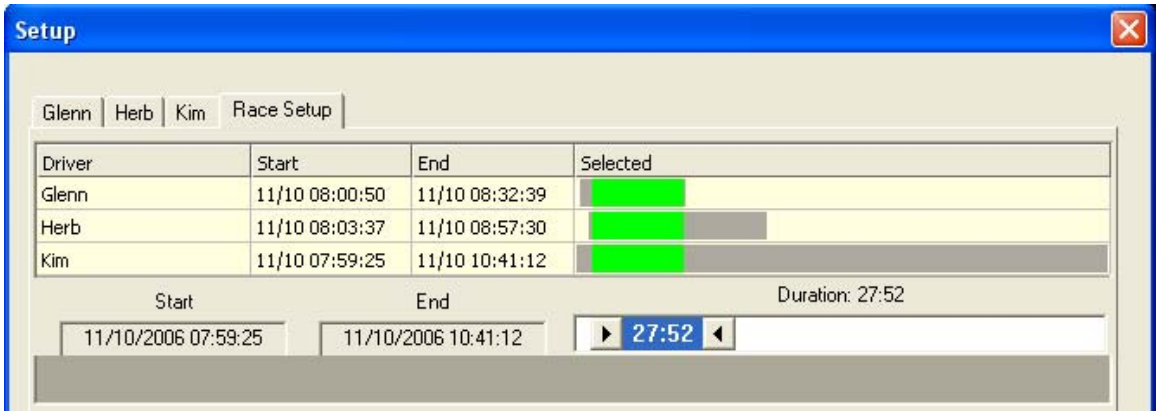


Figure 47 - Race Replay Mode

Move the Duration sliders (< and >) to select the period of time that you wish to replay. The green time zones for each session will show the period of time that each session covers. Use the sliders to select the best overlap of all the sessions.

Once the time period is chosen, you may use the playback controls to ‘Replay Your Day’. You can also display graphs. A useful one is the Velocity vs. Time graph that will show when drivers are on-track or stopped during pit stops.

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System Upgrades

Traqview Updates

From time to time, software updates will be made available for Traqview. These may include new features and may require an update to the firmware in the SU or DU, or both. There will be information on the website that tells you what other requirements there may be for the update.

To check for software updates, go to the Downloads area of traqmate.com. You can check your version number by using the Help/About function in Traqview.

To update your Traqview software, download the installer program from traqmate.com and execute it just as described in the Traqview Software Installation section in this manual. It will remove the old version and replace it with the updated version.

Traqmate SU and DU Firmware Updates

From time to time, firmware updates will be made available for the SU and DU. Note that different firmware is used in the SU for Traqmate Basic and Traqmate Complete.

Traqmate Basic Files
SU: ssu.tqc - Standalone Sensor Unit

WARNING: DO NOT DOWNLOAD SSU.TQC FILE TO TRAQMATE COMPLETE. IT WILL STOP TALKING TO THE DISPLAY UNIT

Traqmate Complete Files
SU: dsu.tqc - Display-enabled Sensor Unit
DU: du.tqc - Display Unit

Each .tqc file is self-contained and includes all the functions required to confirm unit identity, check the code image for accuracy, copy the code image into permanent memory, and reset the unit.

ALL INFORMATION ABOUT DRIVERS, VEHICLES, TRACKS, AND SESSIONS WILL BE LOST WHEN YOU ATTEMPT A FIRMWARE UPDATE*

Connections

For Traqmate Basic, connect the SU as you would for uploading sessions and ensure that you have a good connection.

For Traqmate Complete, the SU is programmed through the DU so you plug it into the DU with the DIN Extension Cable. Plug the DU into the USB port on your computer. Ensure that you have a good connection with the DU. You will do two updates, one for the SU and one for the DU. Select the appropriate .tqc files one at a time. **Always update the SU (dsu.tqc) first since it is programmed through the DU.**

Choose the Tools/Firmware Update option and the filename where you downloaded the .tqc from traqmate.com. Click Start and the rest is automatic. You will be told if the download is successful. You will see LEDs flashing on the SU when it is being reprogrammed and messages on the DU when it is being reprogrammed. You can cancel at any point up to pressing Start. **After pressing START, do not click any other buttons until the unit goes through RESET.**

When firmware update is complete, the Traqmate device being reprogrammed will reset itself regardless of the success of the reprogramming. **DO NOT UNPLUG THE UNIT UNTIL IT RESETS.**

*** Inside Trick**: To keep your Driver/Vehicle/Track information, when reprogramming the DU, click to the User Data screen in Traqview and Get User Setup. Then tab over to Firmware Update, download the du.tqc file and allow the DU to reset. Now click back to User Data. Your data should still be there. Click on Save User Setup.

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TraqStudio Data/Video Integration

Video Integration

TraqStudio has the ability to play back video and audio synchronized with the data playback and to create a video output file with overlaid gauges and text. This is possible because both the data and video have accurate embedded timing information. All of the data features, such as the dashboard, graphs, and maps, are active and will play along with the video. The position slider control can be used to move the vehicle to any position on the track and the video will be positioned to that place as well. You can even open a simulated gauge window over the video showing track location, G-meter, tachometer and speedometer, brake and acceleration, rev limiter, gear selection, lap timer and lap counter.

The data and video can be played in normal speed, fast-forward, slow motion, and frame-by-frame. These are controlled by the VCR-style controls at the bottom of the screen.

Figure 48 - TraqStudio – Actual Video Image

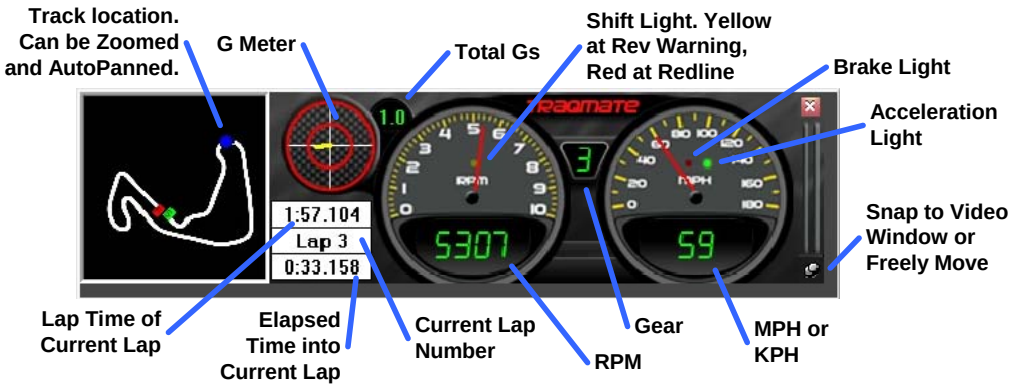

Figure 49 - TraqStudio Dash Displays

TraqCam Instructions

When Traqmate is used with the TraqSync or TraqData II interfaces and the ChaseCam PDR digital recorder, synchronization is automatic. You turn on your Traqmate and ChaseCam with also turn on. When you start the recording on your Traqmate the video recording starts at precisely the same time so the data and video are pre-synchronized. When you stop the Traqmate, the ChaseCam video recording stops also. And when you turn off Traqmate, the ChaseCam PDR will also turn off.

After your track session, take the Traqmate and ChaseCam compact flash card to the computer. Upload the Traqmate data and open it in TraqStudio. Plug your CF card into a USB reader on your PC. Select the video graph option (in Setup) and tell it where your video is located. (Compact Flash drive and folder).

You will see the track map with your car positioned at the Start/Finish. The video will appear in a window, also positioned at the Start/Finish. Hit play and the video and data play together in a resizable window - with audio. You can drag the slider forward and back to position the track position, graphs, and video.

Manual Synchronization

If, for some reason, you would like to fine-tune the synchronization, or if you are using TraqStudio with a camera other than ChaseCam, you will need to use the Video Settings controls.

But first, you need to get video on your computer. If you are using a mini-DV or other tape camera, you can use Microsoft Movie Maker or software that came with your camera to capture the video onto your computer hard disk.

The Video Settings pop-up menu is activated with the Settings button on the top of the video frame. Video Settings gives you the ability to align the data. The radio buttons allow you to shift control of the navigation controls from the data to the video and then lock together for both.

Normal operation is Both. When you drag the slider, press 'Play', single step with >>, or press '+10' or '-10' the data and video will both move together in time.

For realignment, you want to decouple the data and video so you can position each independently. If you select 'Data', the vehicle will move around the track map without realigning the video. Conversely, if you select 'Video', the slider controls will reposition the video only.

NOTE: In most cases, when synching data and video you should select either All Laps or the first few laps including the incomplete lap at the beginning (1i) so you have a reference point.

TIP: You can use the track map, the Acceleration and Braking lights on the dashboard, and the vs. Time graphs to help you find common reference points in the video and data. You can even

create your own synch point by hitting the brake hard and waving your hand in front of the camera.

General Sync Technique

The time slider only represents the timeframe of the data recording so it is generally best to choose a video reference first.

Select Setup/'All Laps'. Select the 'Video' video setting and position the video to a known location such as the Start/Finish line or the start of a turn.

Select the 'Data' video setting and then position the data to the same place on the same lap.

Select 'Both' and play the video. Watch the track position and the dashboard for G-forces and compare them to turn-in, braking points, and shift points.

Once you are close, use the single step '>>' and '<<' controls to adjust as necessary.

Writing Videos

TraqStudio has the capability to save a video with gauge overlays into an output video file. This can be optimized for the video's intended use with a button press. Selections are Web for posting to YouTube or other internet video hosting service, DVD for burning to a DVD that can be played on a TV, or PC for files that will be archived and played back on a PC.

Video Write is activated by the "Write Video" button on the top frame of the TraqStudio video window. The laps that are selected in the Driver Setup window are those that will be written to the output file. This includes selection of Theoretical Best Lap (TBL). This makes it very easy to select only your best lap to post on YouTube or to save your Theoretical Best Lap as a reference video. Of course, you can also save entire races, autocrosses, or rally stages.

When the Write Video button is pressed, the video editor screen is displayed.

Figure 50 - TraqStudio Video Editing Screen

Input Options

The input video file is chosen within TraqStudio when the video file is opened. Supported input video formats include MPEG1, MPEG2, WMV, and AVI.

Output Options

Output Video – TraqStudio will make up an output file name. Click on Change Output to select the location and name of the video file to be created and the video format.

Video Formats

Guess	Let TraqStudio pick the best file format for you, generally the same as input file.
MPEG1	Motion Pictures Expert Group 1, an older video format, used by some digital studios.
MPEG2	Motion Pictures Expert Group 2, format used by ChaseCam PDR and DVDs.
AVI	Audio Video Interleave, a common computer video format
WMV	Windows Media Video, the standard format for Microsoft Windows
FLV	Flash format used for web streaming
SWF	Flash format used in ads and moving graphics

Common Settings – quick choices for common applications. Automatically sets aspect, size, quality, and styles.

Web	Lower resolution for quick posting on the web
DVD	High resolution for writing to a DVD
PC	For playback with VLC, Windows Media Player or other PC video player program

Output Aspect Ratio – pick the format of the intended display device

4:3	Standard Definition
16:9	High Definition (widescreen)

Video Size – pick the horizontal and vertical resolutions that best match your application. If you choose a resolution higher than your source video, TraqStudio will “upconvert” the content.

Quality – This is the video compression level that directly affects output file size. MED produces nice output with a reasonable file size. Use HIGH if you want the best quality possible and LOW if you have file storage constraints.

Dash / Info – These tabs allow control of the placement, look, and content of the data overlay graphics.

Dash	select dash transparency, style (NORMAL is Green on Black, HIGH CONTRAST is Black on White), and position.
Info	enable/disable text box, change the text if desired, and select background transparency and position.

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Screen Features

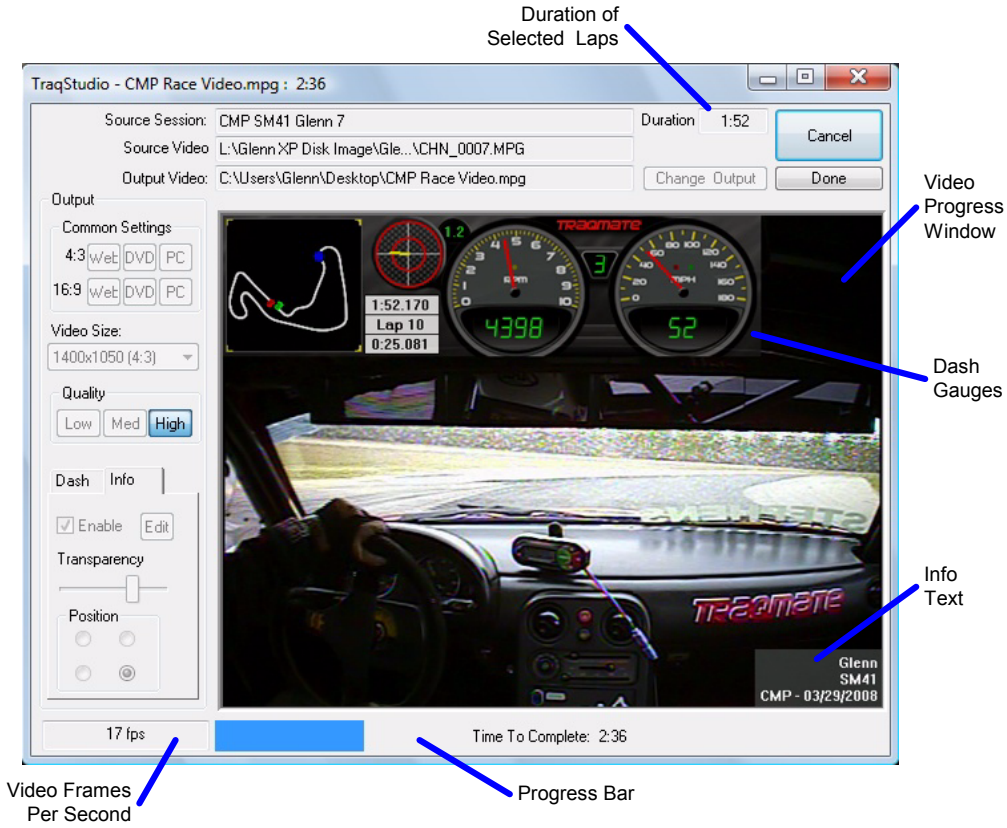

Figure 51 - TraqStudio Video Output Screen

Creating a CD

Most PCs have the capability to write a CD. This is a convenient and quick way to share large amounts of information. Unfortunately, video files are very large so most will not fit on a CD. If you create a video file of a single lap, you can probably save it on a CD, depending on the output file settings. A CD will hold about 660Mbytes of data. Most computers can play the video file right from the CD, although slower CD drives will cause skipping.

Creating a DVD

There are multiple formats of DVDs, some of which can operate on PCs and some in DVD players. For the sake of simplicity, this discussion collapses the list down to two types - Data DVDs and Video DVDs. To create either type of DVD, you must have a computer that is capable of writing DVDs. Many computers can play a DVD (read) but cannot create one (write).

Data DVD

A Data DVD is one that is created and used on a PC as a storage device. Later versions of Microsoft Windows allow you to create a Data DVD and copy files onto it with Drag and Drop. This is a convenient way to share a video but, as with CDs, you can create a video too large to fit on a DVD depending on output file options. A DVD can hold about 4Gbytes of data. This type of DVD cannot be played in a conventional DVD player on a television.

Video DVD

At this time, TraqStudio cannot directly write a Video DVD. To do this you will need to create a video output file and then use a DVD authoring program such as Windows DVD Maker that is supplied with Windows Vista. Depending on the video authoring program, this process may be very time-consuming due to a format translation called transcoding on the video file.

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TraqTach / TraqData Installation and Setup

Hooking up a Tach Input (TraqData, TraqTach, TraqSync)

This requires a TraqData, TraqTach, or TraqSync interface module. The instructions are similar for each unit.

The original grey-case TraqData and TraqTach devices came in two voltage ranges, 'Electronic' and 'Coil'. Later black-case TraqTachs, TraqSyncs, and the TraqData II are switchable but come set for 'Electronic'.

The 'Electronic' setting works with most modern cars with either a 5V or 12V tach signal. 'Coil' works with older cars with a 12V signal or by attaching directly to the negative coil terminal.

Changing Voltage Range of TraqTach, TraqSync, and TraqData II

To open a TraqTach or TraqSync (black case), gently pry open the cover of the 15 pin connector. Be careful not to lose the thumbscrews.

To open a TraqData II device, remove the two screws on the bottom of the unit and lift off the top cover.

For all devices, there is a very small dip switch on the circuit board that is covered in transparent tape. Use a sharp instrument to flip it to the other position.

Selecting the Tach Signal

First you must find a signal that pulses at least once per engine revolution. You will need to attach a wire to this signal using either a wire tap or a hard contact such as a spade lug. If you use a wire tap, take special care not to cut the source wire. There are several places where a signal may be located on your car.

Figure 52 - Tapping ECU Signal

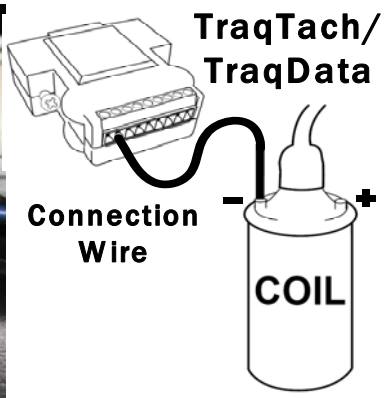

Figure 53 - Connecting to Ignition Coil

- **If using an MSD or similar capacitive discharge ignition use the supplied TACH signal. DO NOT CONNECT TO THE COIL.** Set switch to 'ELECTRONIC'.

- For older vehicles (generally 1976 and earlier), locate the ignition coil. Connect to the terminal labeled '– '. Set switch to 'COIL'.

- For many modern cars, there is a 5V or 12V ECU signal labeled TACH or IGN that is a single or double pulse per engine revolution. Set switch to 'ELECTRONIC'.

- For many vehicles, you can tap the wire going to the tachometer in the instrument cluster. Set switch to 'ELECTRONIC'.

- For fuel-injected vehicles, you can use a fuel injector signal. Set switch to 'COIL'.

- For distributor-less ignition, you can use a low voltage coil-on-plug signal. Set switch to 'COIL'.

Terminating Wire at Input Device

Attach a wire to your tach signal source. For original TraqTach and either TraqData input modules, run a wire to the module and terminate it securely in the screwdown terminal labeled 'RPM'.

For black-case TraqTach and TraqSync modules, connect the tach signal to the TraqSync blue wire using the supplied crimpless connector.

Plug the input module into the Traqmate Sensor Unit.

If you are operating Traqmate on vehicle power, there is only one connection required. If you are operating on battery power (not recommended for TraqTach or TraqData), you must connect the terminal labeled 'GND' to vehicle ground or ground the Traqmate Sensor Unit case.

Refer to the section of this manual entitled 'Traqview Analysis and Configuration' to set up Traqmate so that the proper RPM is displayed on the unit and in Traqview.

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Hooking Up Data Inputs and Outputs

Traqmate can deliver amazing results with just the internal GPS and accelerometers but sometimes you want to monitor other external points in the car such as air/fuel mixture for tuning the vehicle or perhaps steering angle to better evaluate driver and setup. For this purpose, Track Systems offers the TraqData analog and digital input device. There are two versions of this device, TraqData and TraqData II. This section applies to both units unless explicitly specified.

TraqData contains screwdown terminals for 4 Analog, 2 Digital, and 1 RPM connections. It also contains a 5V reference line for resistive sensors. TraqData II also has a 12V power line that can be used to power a sensor up to 100mA. TraqData is a convenient way to monitor external sensors for temperature, pressure, deflection, or just about anything else. However, connecting electrical components requires some knowledge of voltage, current, and wiring. If you hook up something wrong, you risk damage to yourself, your vehicle, and your Traqmate.

If you do not have electrical knowledge, get help from your Traqmate dealer or a friend with the proper experience.

Digitals

Inputs

Digital Inputs are straightforward. Tie them to a signal that measures between 0V and 0.5V in one state and between 3V and 20V in the other state. An example is the brake light. Tap the wire going to the brakes and attach it to either the D4 or D5 terminal.

0V is a logic 0, 3V+ is a logic 1. If input is not connected it will read as a 1. You can change the definitions of the digital points to define “ON” and “OFF” using Traqview.

If a ChaseCam PDR is connected, D4 cannot be used as an input.

NEVER CONNECT A DIGITAL INPUT TO THE COIL OR OTHER HIGH VOLTAGE SOURCE.

Do not configure the Digitals as Outputs in Traqview if they are connected as Inputs. This could damage Traqmate and/or the vehicle.

Outputs

Digital Outputs are used to signal when a pre-programmed event occurs. When activated, they form a connection to ground. Each Digital Output is an open-collector signal and will normally read approximately 2 Volts when not “activated”.

If a ChaseCam PDR is connected, D4 must be left unconnected. Otherwise, Digital Output D4 may be used as an alarm notification for RPM or the A0 Analog input. D5 may be used as an alarm notification for RPM or the A1 Analog input. When used as an alarm, these outputs can be used to trigger a relay to an external warning light or directly drive a low-current indicator such as an LED.

The figure below shows the connections required to connect an external light or LED to a digital output. The max sink current on each digital output is 250mA. If you use a relay, you must have a current limiting diode for the flyback current as shown below.

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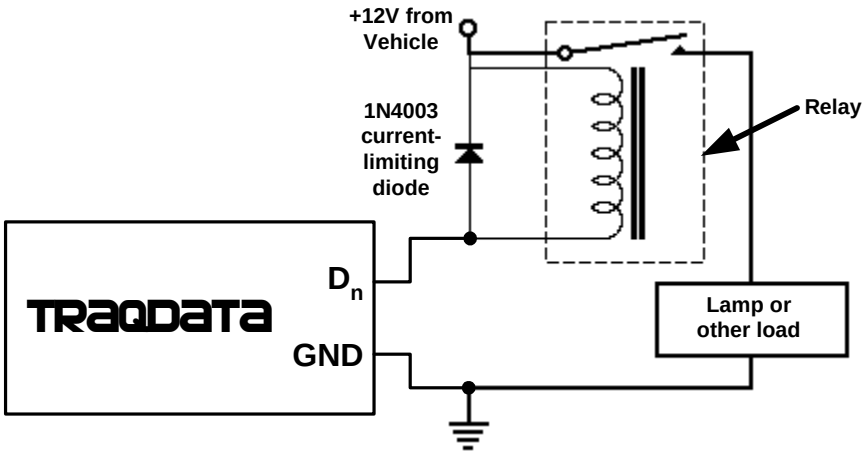
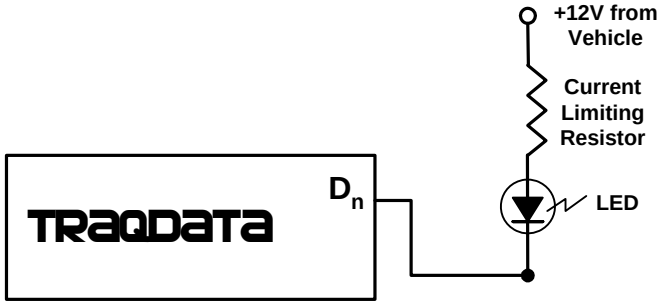


Connection to Warning Lamp or High Current Load



Connection to LED or Low Current Load

Figure 54 - Digital Output Connections

Analogs

Analogs are a little trickier. There are many ways they can be attached depending on the electrical characteristics of the sensor.

Rules

1. The resistance on the 5V reference must be greater than 470Ω. You must have a series resistor if you hook it to a variable resistance sensor.
2. Do not use the vehicle's 12V power as a reference voltage as it changes depending on charging status. Use the supplied 5V source instead.
3. The maximum voltage you can monitor is 20V. Do not exceed this or you can damage the Traqmate.
4. If you are using batteries (not recommended for TraqData), you must connect the sensor ground to the TraqData GND terminal.
5. If you are operating off vehicle power (recommended), your sensor circuit must be grounded to the vehicle or attached to the TraqData GND terminal.
6. If you place sensors near high voltage sources you may corrupt your signal with electromagnetic interference.

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Requirements

To setup and use TraqData you will need the following:

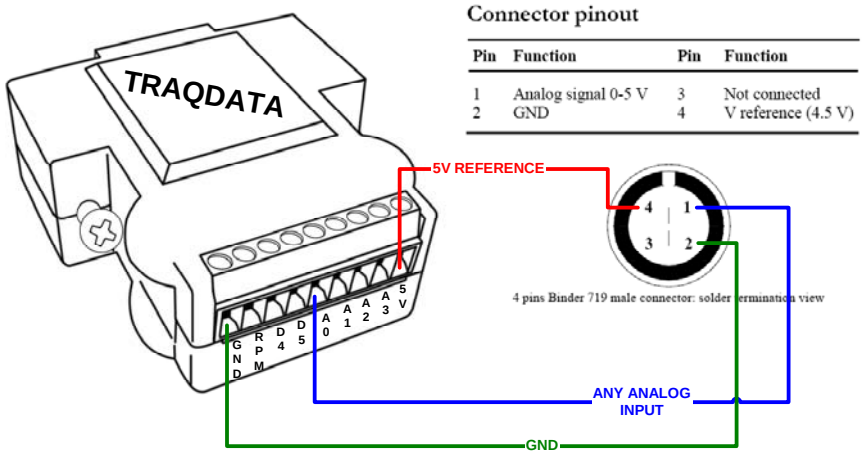
- Traqmate Complete or Traqmate Basic System
- TraqData input device
- PC with Traqview installed
- 20 gauge or smaller wire (the higher the gauge the smaller the wire)
  - This is a size issue not an electrical issue. Larger wire will not fit into the screwdown terminals on the TraqData or TraqTach device.
- Means to terminate wires (spade lugs, wire taps, solder, ring lugs, etc.)
- Very small screwdriver for screwdown terminals (blade < 0.08" or 2 mm)
- Crimper tool
- Wire cutters
- Wire strippers
- Volt-Ohm Meter (VOM)
- Sensors and series resistors as desired

Analog Input Installation Overview

See detailed instructions for these steps in subsequent pages.

1. Identify which input points are to be monitored. These could be points already available in the vehicle (electric oil pressure gauge) or require new sensors (steering wheel deflection).
2. Give each point a name and identify the units in which to report this input point. (i.e. PSI, Ratio, Deg-C, Degrees, or possibly just Volts). If the value you want is not on the list you can just type it in.
3. Wire up a sensor with an appropriate series resistor (if necessary).
4. Measure the resistance or voltage at either end of the range. For example, if you are using a thermocouple, heat it to the max temperature and cool it to the min temperature and measure the temperature and resistance/voltage at either extreme. You can measure the voltage using the Inputs screen on the Display Unit or with a VOM.
5. Enter the information into Traqview and enable the data point.
6. Turn on data collection (must have GPS signal!) and record some data.
7. Upload into Traqview and verify the results. Tweak as necessary.

Many customers use sensors purchased from AIMsports.
The mating connector for the sensors is a Binder 719 Female.
Connectors and cable assemblies are available at http://www.binder-usa.com.



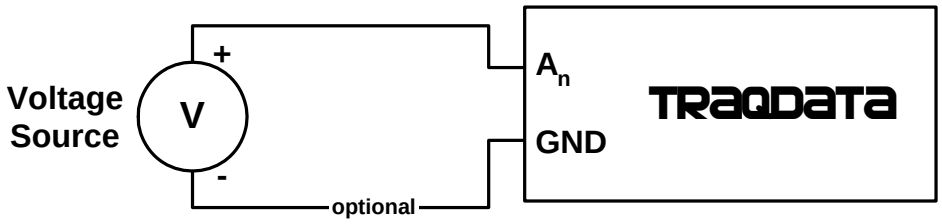
Connector pinout

Pin	Function	Pin	Function
1	Analog signal 0-5 V	3	Not connected
2	GND	4	V reference (4.5 V)

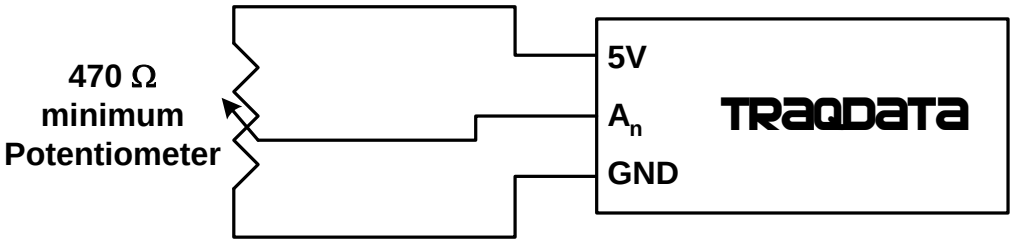
Figure 55 - Connecting AIMsports Sensors

The diagrams below show a selection of sensor types and suggestions for connecting them to the TraqData interface.

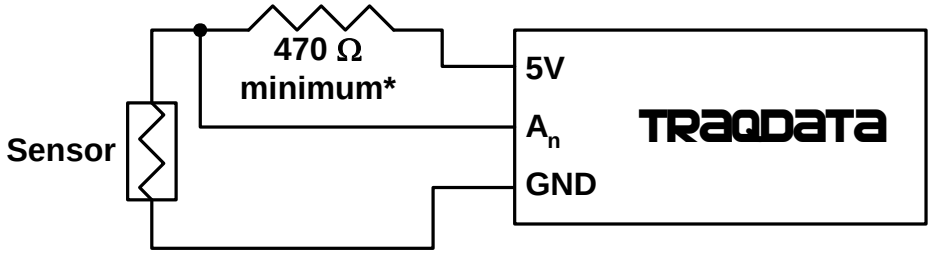
Source supplying scaled voltage (example, Lambda sensor)



Potentiometer (example throttle position sensor, suspension deflection sensor)



Variable resistance sensor (example, thermocouple, pressure sensor)



** Value for resistor should be roughly equal to maximum resistance of sensor.*

Input to existing gauge

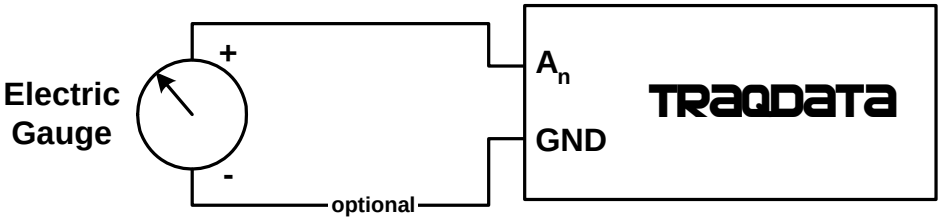


Figure 56 - Analog Sensor Connections

Hooking up a ChaseCam PDR100 (TraqCam Setup)

The Traqmate can be used to control the recording on a ChaseCam digital video recorder. This requires either a TraqSync or TraqData II ChaseCam interface or a TraqCam cable that connects the ChaseCam PDR100 to a TraqTach or TraqData digital input/output device. With TraqSync / TraqData II, the recorder will be automatically powered up and down. Either connection will start and stop video recording in synch with the data recording.

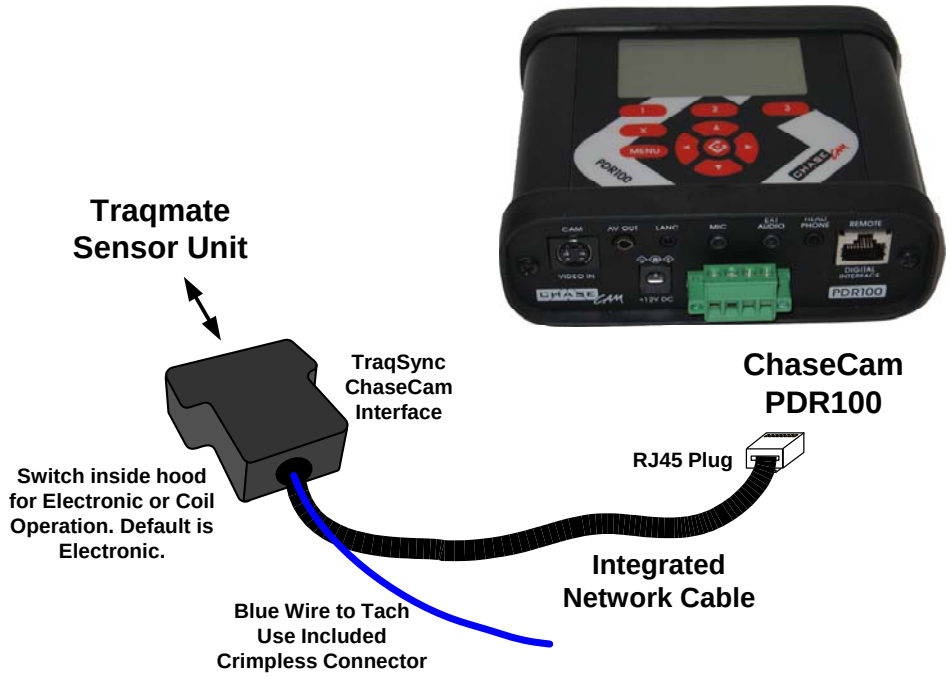


Figure 57 - TraqSync Connection to ChaseCam PDR100

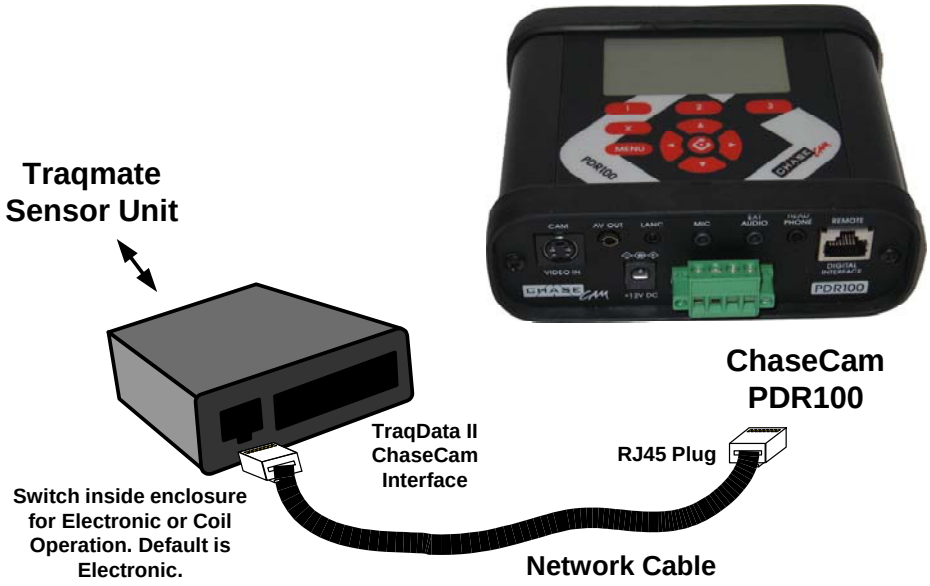


Figure 58 - TraqData II Connection to ChaseCam PDR100

TraqCam cables have been discontinued in favor of the more robust and capable TraqSync interface but the connection method is shown here in support of legacy users. For a TraqTach, use the ALT connection point and for the TraqData use the D4 connection point

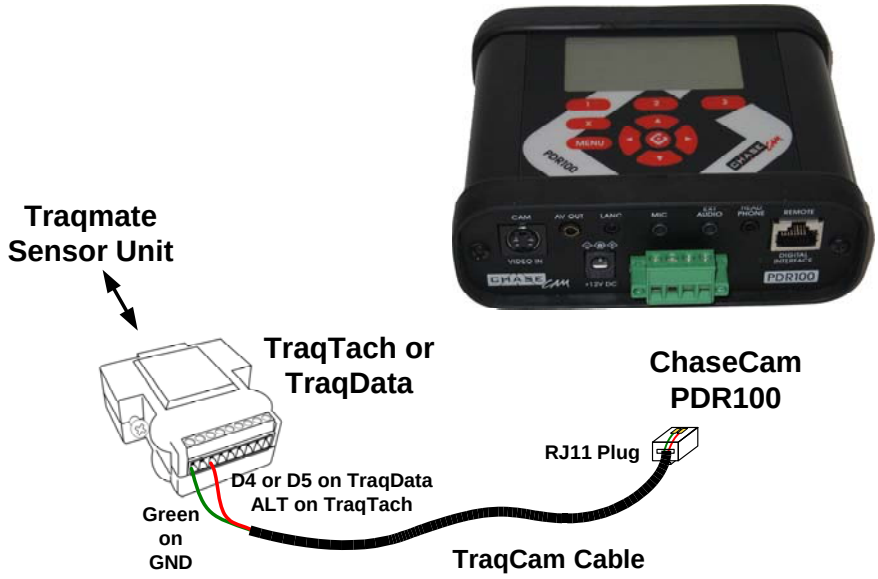


Figure 59 - TraqCam Cable to ChaseCam PDR100

After making the physical connections, you must set up a digital output on the Traqmate using Traqview as shown below. This is the default for Traqmates released after V2.10. Note that you do not have to check 'Input Enable' if you do not have any digital inputs. This will maximize recording time.

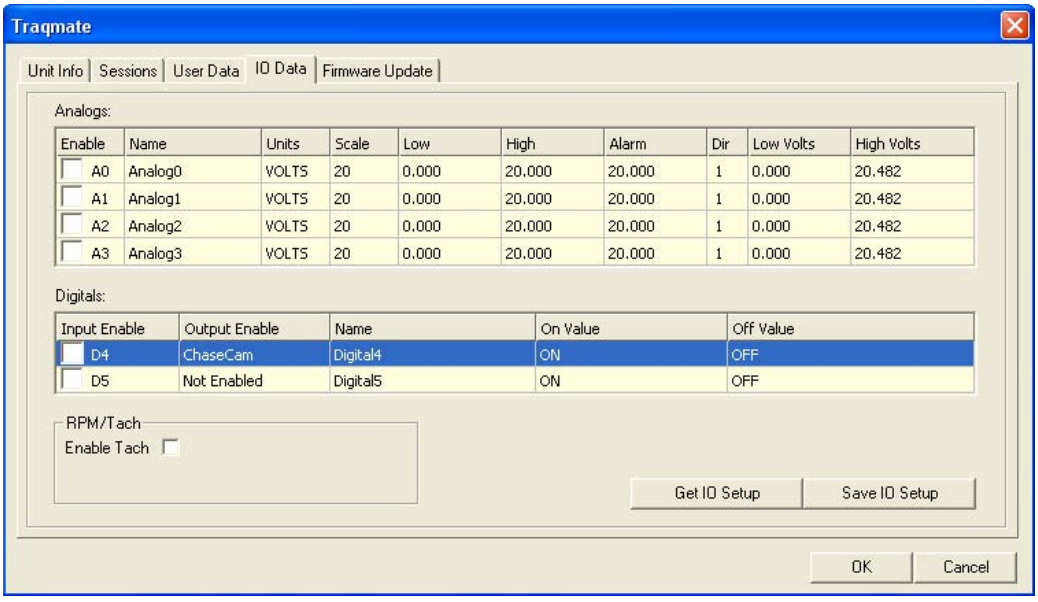

Traqmate
Unit Info
Sessions
User Data
IO Data
Firmware Update
Analogs:
Enable Name Units Scale Low High Alarm Dir Low Volts High Volts
A0 Analog0 VOLTS 20 0.000 20.000 20.000 1 0.000 20.482
A1 Analog1 VOLTS 20 0.000 20.000 20.000 1 0.000 20.482
A2 Analog2 VOLTS 20 0.000 20.000 20.000 1 0.000 20.482
A3 Analog3 VOLTS 20 0.000 20.000 20.000 1 0.000 20.482
Digitals:
Input Enable Output Enable Name On Value Off Value
D4 ChaseCam Digital4 ON OFF
D5 Not Enabled Digital5 ON OFF
RPM/Tach
Enable Tach
Get IO Setup
Save IO Setup
OK
Cancel

Figure 60 - Enabling ChaseCam PDR100 Control

ChaseCam PDR100 Digital Video Recorder Operation

To operate, make sure the ChaseCam PDR100 is ready to record (power, compact flash card, and camera). When used with a TraqSync cable or a TraqData II interface, the PDR-100 will power up shortly after the Traqmate is turned on. It will turn off shortly after the Traqmate is powered down. If you manually power off the ChaseCam, Traqmate will power it back up again to ensure readiness.

When you enter a recording mode on the Traqmate, it will automatically start recording on the ChaseCam when GPS lock is obtained. This will ensure synchronization between the data and video for use in TraqStudio. When recording is stopped on the Traqmate, the ChaseCam recording will also stop.

NOTE: If you are using a TraqTach or the original TraqData module, Traqmate will not power on or off the ChaseCam PDR. You must do that manually.

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ChaseCam SS1000 Split-Screen Processor Operation

If you wish to add a second camera angle, you will need a ChaseCam SS1000 Split-screen Processor. This unit will combine two camera inputs as either a Split-Screen or a Picture-in-Picture. The SS1000 operates all the time and its video output goes to the video input on the ChaseCam PDR100 recorder.

To operate, make sure the ChaseCam SS1000 has power. It is always on when power is applied so you may wish to connect it to a switched power source to avoid draining the vehicle battery.

NOTE: Do not power the SS1000 from the PDR100 output connection – damage to the PDR100 will result.

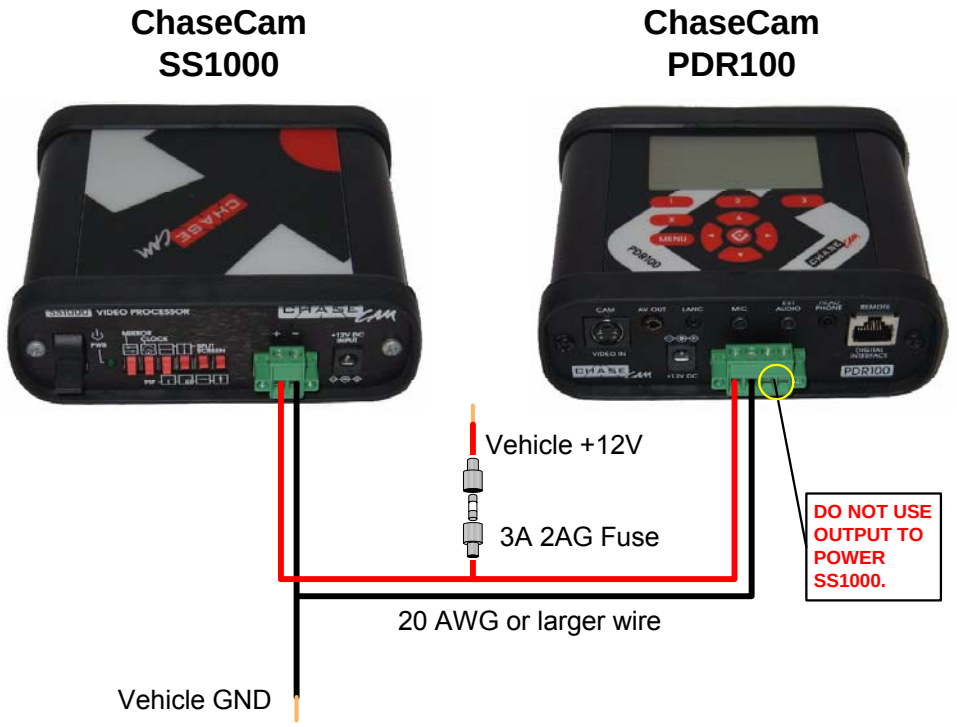

Figure 61 - Adding a Second Camera - ChaseCam PDR100 & SS1000

Using Traqmate for Analysis

This section will serve as a tutorial for using the Traqmate Data Acquisition System for analysis of drivers and vehicles. There are many ways to use the data and these are only a few methods. It is always best to experiment to find the specific areas of interest for your situation.

Driver Comparison

When comparing drivers, it is best to record laps in the same vehicle or at least very similar vehicles. Otherwise, the performance capabilities of the vehicle can mask the differences in the drivers. In addition, driving styles differ between types of cars. A good driver will have different braking, turn in, and acceleration points in a front-wheel-drive car than in a rear-wheel-drive car.

Best Lap Playback

The easiest way to compare drivers is to pick their best single laps, load them up on the track map and play them back. Watch the entire lap and note where one driver pulls away significantly from the other. Then concentrate on those areas using the other Traqview tools.

Best vs. Worst Playback

Sometimes you can see differences most readily by taking the best and worst laps of a session for a single driver. This can make mistakes more apparent. Add in the Theoretical Best Lap to check for consistency.

Velocity vs. Distance

Driver differences are most apparent when viewing the Velocity vs. Distance graph. To get an accurate picture you may need to look at several laps because you never know what happened on a single lap. A driver might have lifted to avoid another car or may have had the advantage of a draft from another car on a straightaway.

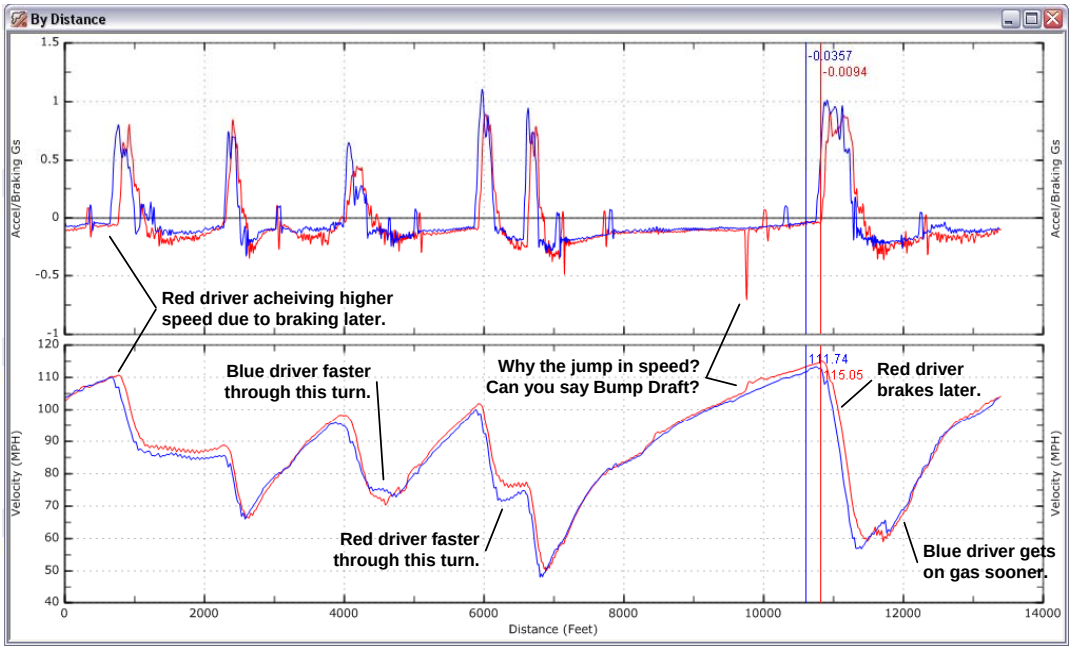

Figure 62 - Velocity vs. Distance Analysis

After looking for areas of improvement on the Velocity vs. Distance Graph, you need to determine just how to make those improvements. The best way is to create a segment surrounding the corner on the track to be improved.

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Driving Line

Generally, it is best to be “Slow In, Fast Out”, especially if there is a long straight after the turn in question. That faster exit speed will compound over the entire distance of the straight. Segments are the perfect way to test entrance speed vs. exit speed. If you are entering a long complex of curves, it may be smart to be Fast In, Slow Out. The best way to determine this is to create two segments on consecutive sections of the track. This way you can see if sacrificing entrance speed on one section leads to commensurate gains on the next section.

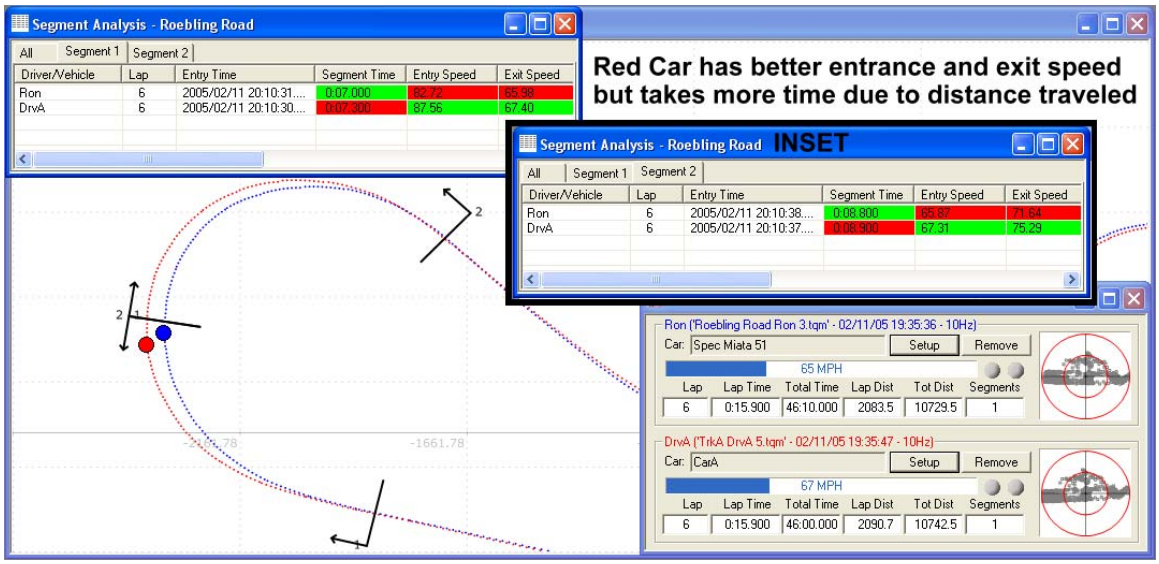


Figure 63 - Segments and Driving Line Analysis

Segments

Sometimes entrance and exit speed can be deceiving. Segment Analysis can also show you the real story. In this diagram, taking the long way around results in higher speeds but longer times.

G vs. Distance Analysis

The G vs. Distance graphs show the G forces on the vehicle plotted against the distance traveled. This is very useful for viewing the overall performance envelope that a driver is using in the car. On the graph below you can see that the green car's graph lines are consistently outside the blue car's, indicating that the green car is carrying more speed through the turns and consequently generating more lateral cornering force.

Another useful element of this graph is the ability to determine when a driver hits the brakes and throttle. You can clearly compare when each driver hits the brakes, gets off the brakes, and gets back on the gas. You may want to apply a filter to the graphs to get a clean edge for comparing brake application points.

This graph is also good for comparing braking curves for the drivers. Optimally you want to see a good crisp initial brake pressure, even pressure during braking, and then a clean transition off the brakes and into the turn. If you position the cursor at the end of the brake application (as shown), it should also intersect the turn in point.

Also look for nice smooth lines. Spikes in the acceleration line indicates a throttle lift or brake tap, which is usually not desirable.

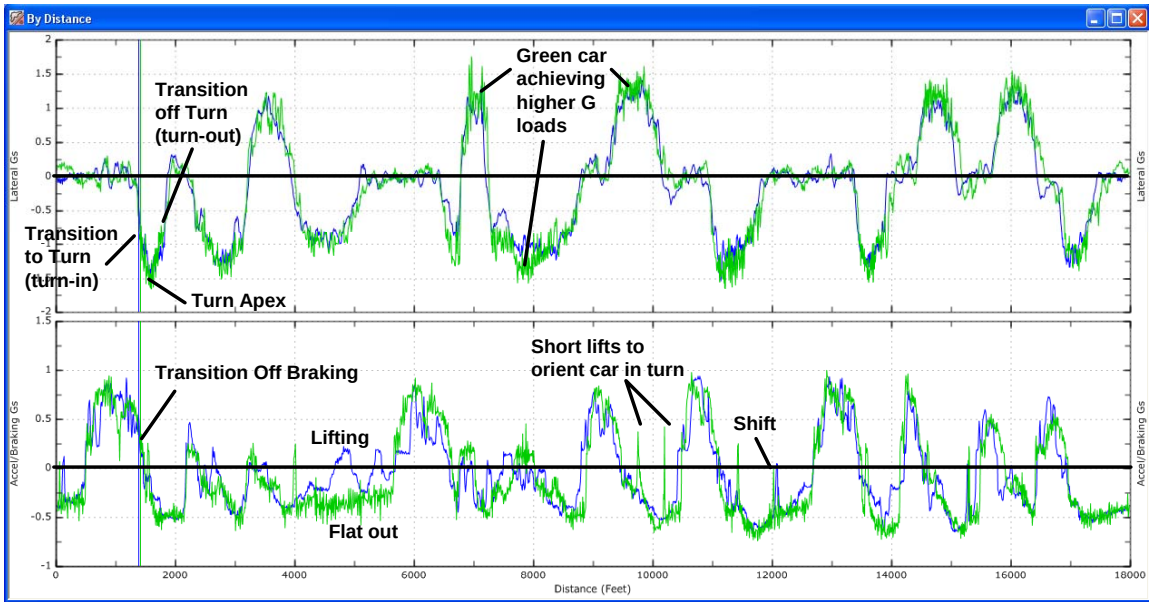


Figure 64 - G vs. Distance Analysis

Friction Circle

Often you can get a quick idea of driver's skill by simply looking at their Friction Circle plot. A beginning driver will generally have a plot that appears like an inverted T with dips on the sides. This is because they brake straight, get off the brakes, then turn.

As a driver gains experience, his Friction Circle will be much more triangular and follow the perimeter of a triangle. This happens because the driver is transitioning from braking to turn-in in a coordinated fashion. A very experienced driver's Friction Circle will have a visible hole in the center showing that the maximum grip of the car is being used at all times. When playing back in real-time you can see the cursor go around the outside of the triangle during transitions from braking to turning and back.

To determine how much of the performance of the car is being utilized, do a skidpad test as described in the vehicle performance section below.

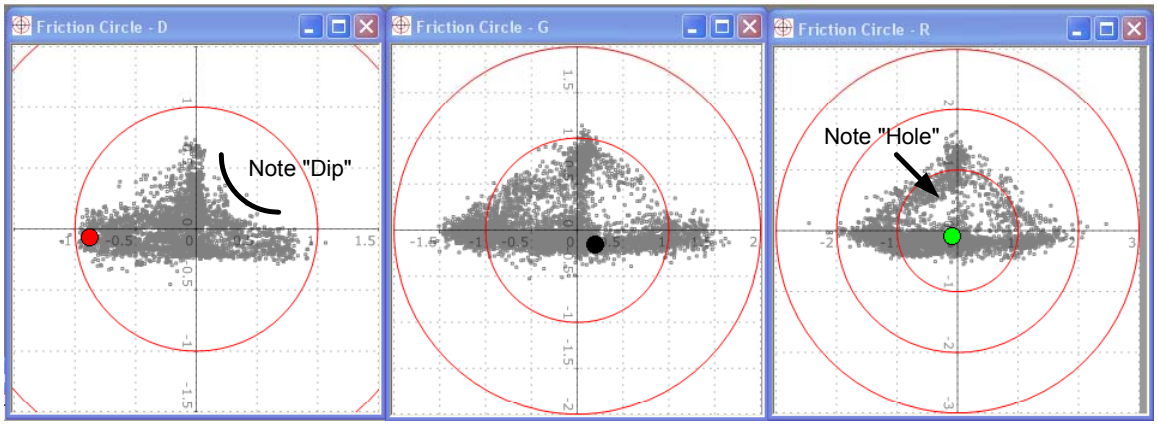


Figure 65 - Friction Circle Comparison

Graphing Multiple Data Elements (Stacked Graphs)

With Traqview, all the items on the graph are synchronized as you play back one or more laps. Use the Setup button on the dashboard to add elements to the common scale distance or time graphs and then play it back to see the relationship between the various elements being monitored.

As you configure Analog and Digital points in Traqview, they are added to the available items in Setup by name. In this graph, RPM has been collected using the TraqData input device.

In this analysis you can see the brakes applied before the turns, you can see the RPM peak at the redline, shift points in both the track map and Accel/Braking graphs, and the RPM drop after a shift.

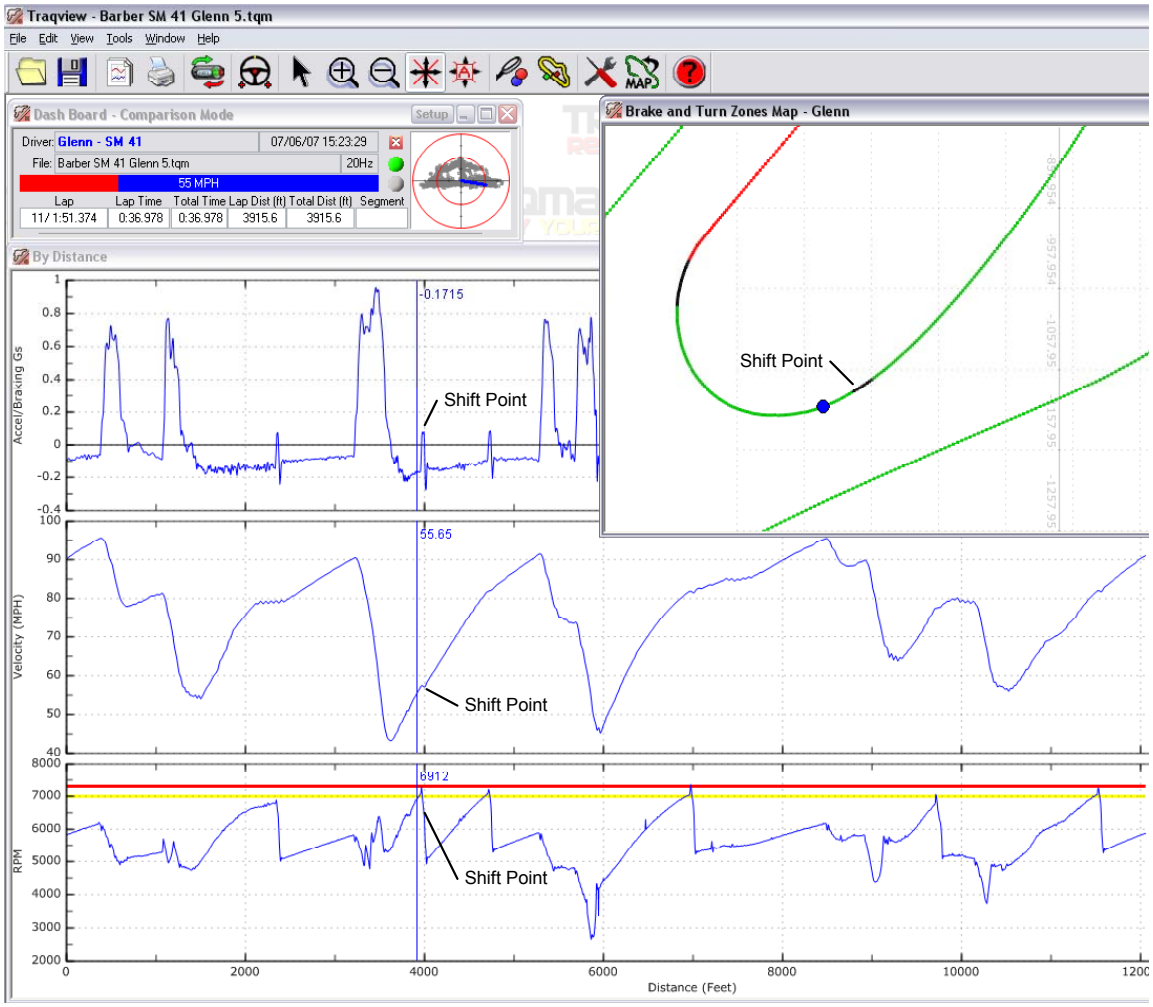


Figure 66 - Stacked Graphs

Vehicle Performance Comparison

Traqmate can measure many performance capabilities of the vehicle, including acceleration, braking, and lateral grip.

Acceleration and Braking

A good way to evaluate horsepower is to draw segment on a straight part of the track between shift points and in the brake zones. Then look at the Max Acceleration and Max Braking values in that segment. You can also see the difference in power between vehicles visually by looking at the slope of the lines in the Velocity vs Distance Graph since the rate of gain of velocity is acceleration. Similarly, by looking at the negative slope one can determine the strength of the brakes (and of course the adhesion of the tires).

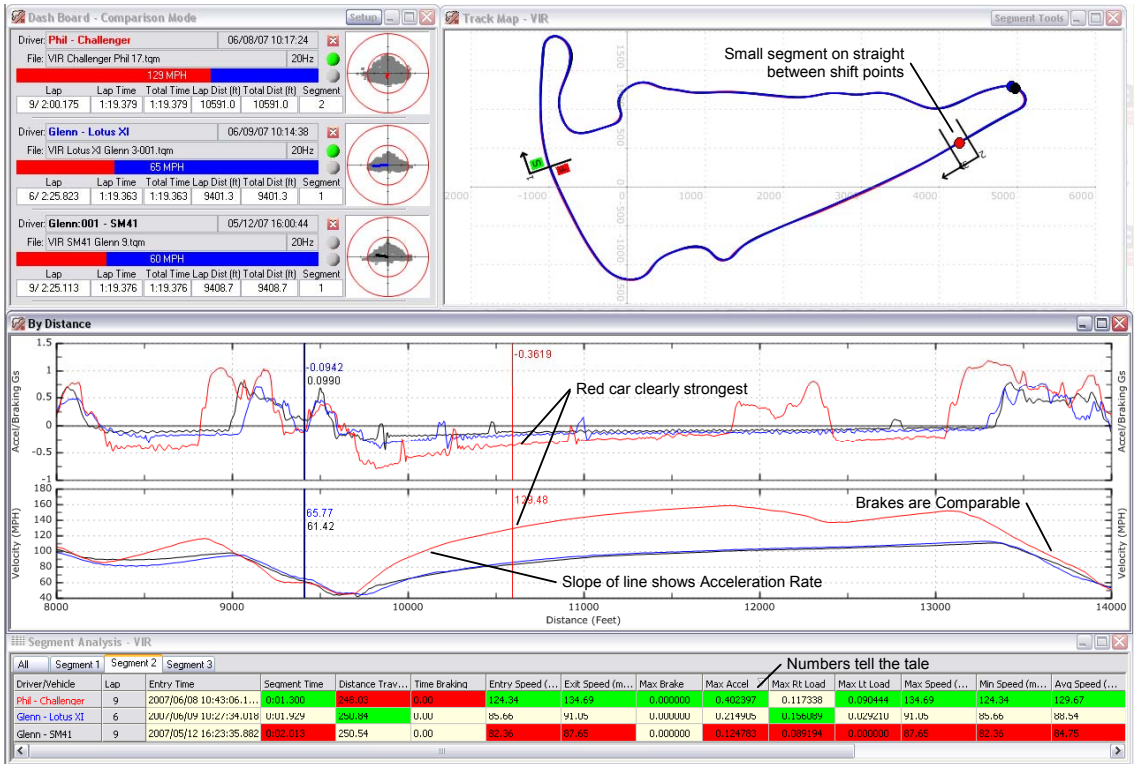

Small segment on straight between shift points
Red car clearly strongest
Brakes are Comparable
Slope of line shows Acceleration Rate
Numbers tell the tale

Figure 67 - Acceleration and Braking

Lateral Gs

To evaluate the outer limits of chassis adhesion, the proven method is the skidpad. Traqmate is an ideal tool for collecting and analyzing skidpad data.

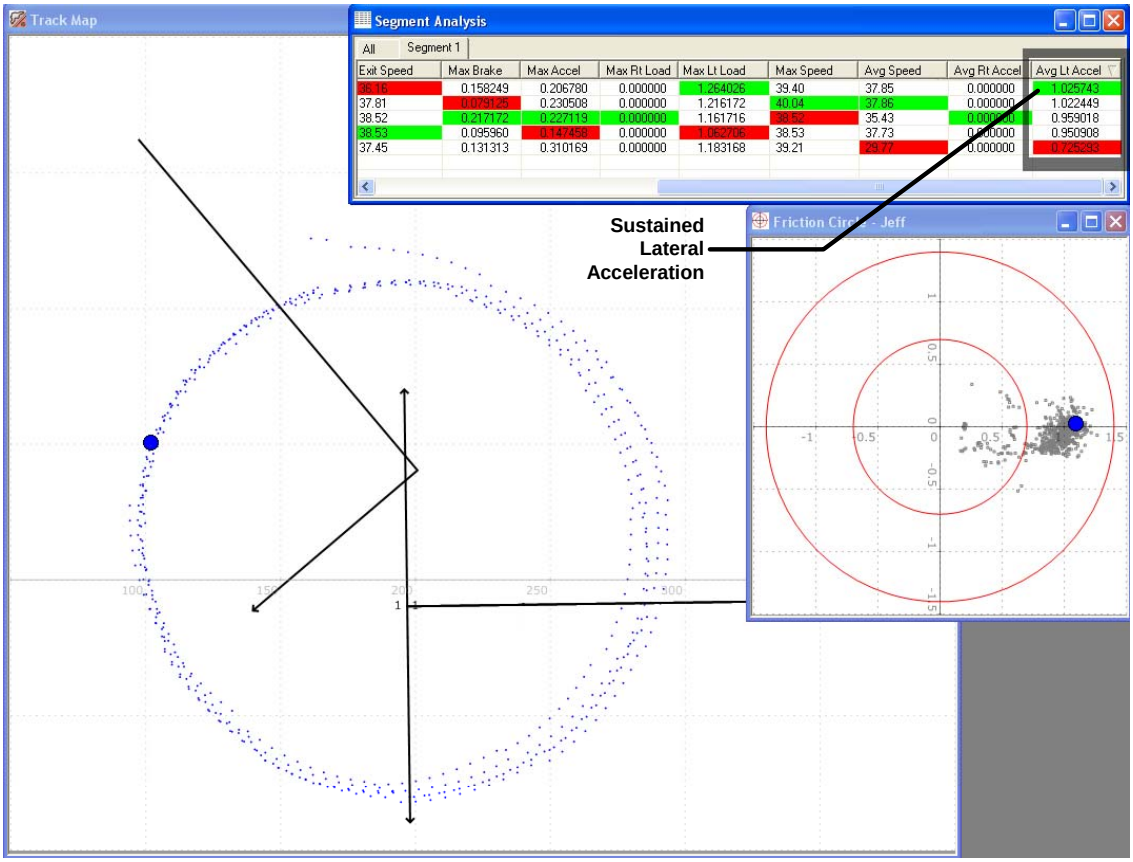


Figure 68 - Skidpad Analysis

Safety

There is nothing fun about going off-track or spinning. That is why we take safety very seriously at Track Systems, and we hope you do as well. Please operate your Traqmate in a safe manner by ensuring that your Traqmate is securely fastened in the vehicle and that you only look at the DU screen or SU front panel when you are in a position to do so.

That said, occasionally accidents happen. The unpredictability of high performance driving is one of the things that make it so thrilling. When the unpredictable happens to you, Traqmate can help you learn what happened so that you can correct a mistake or be prepared for a similar situation in the future.

For example, look at this comparison of a good lap in red with an unsuccessful lap in blue – same car, same driver. It is easy to see what happened, the car was offline and going too fast which resulted in the vehicle leaving the track.

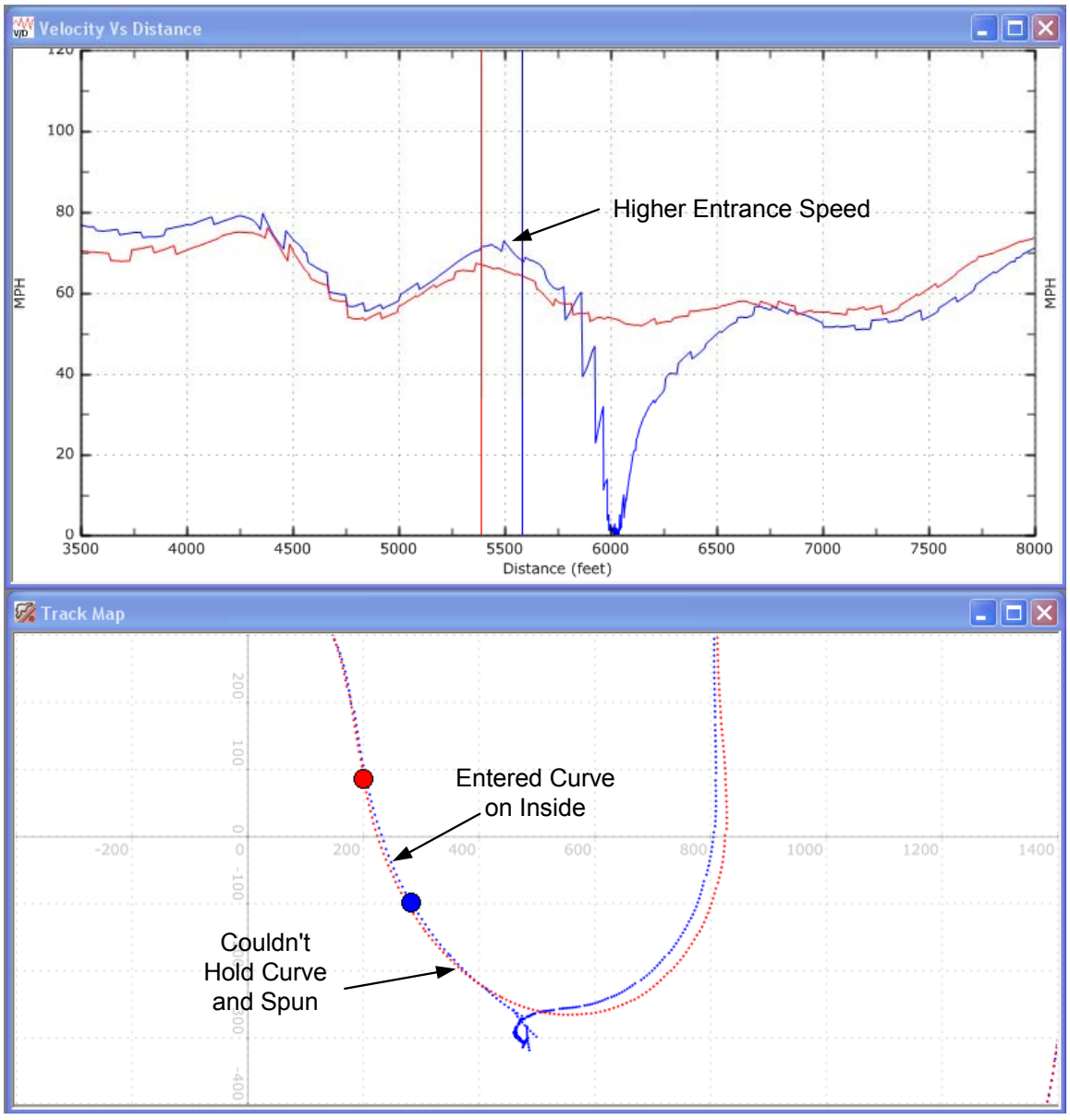


Figure 69 - Spin Diagnosis

And finally, when you are replaying your day with your track buddies, Traqmate makes a great storyteller. During the extensive testing of the Traqmate System we had our share of bumps along the way. We thought we would share a couple of our best off-road excursions.

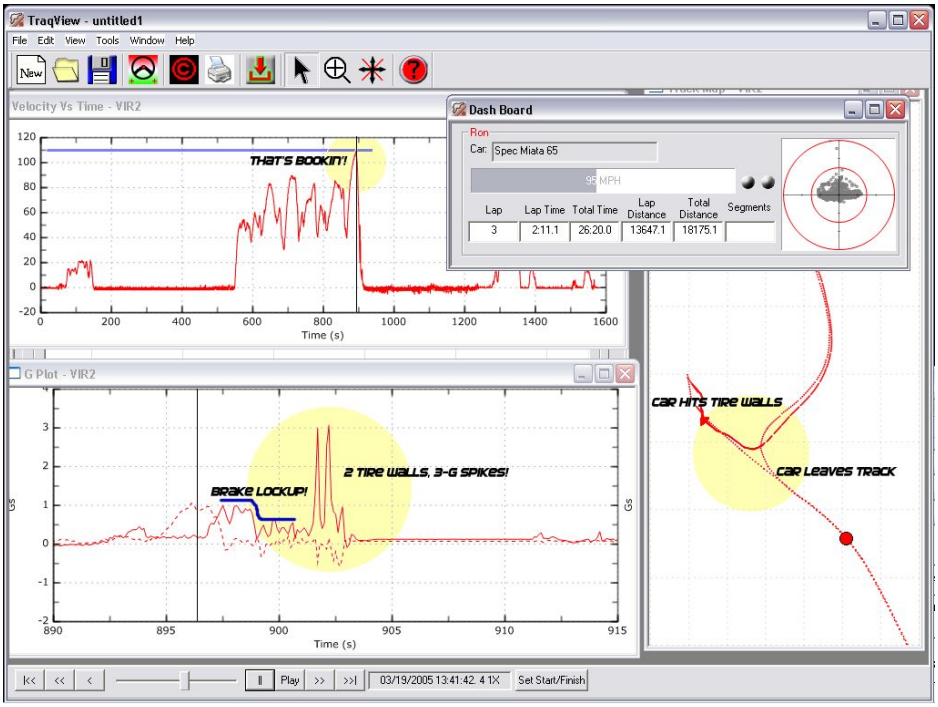


Figure 70 - VIR Turn 14

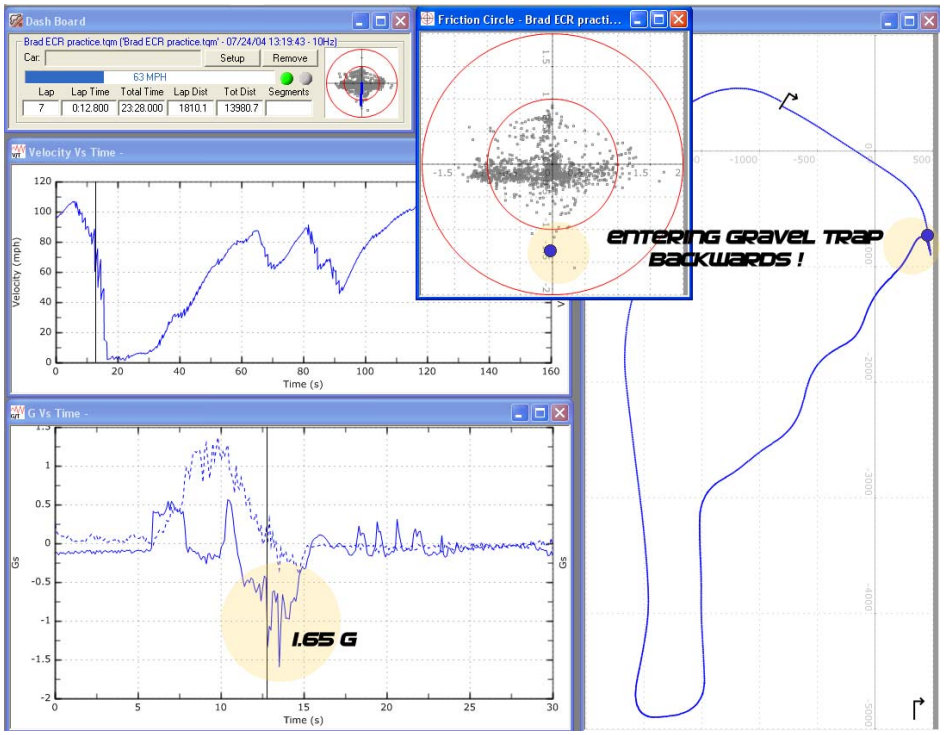


Figure 71 - Road Atlanta Turn 1

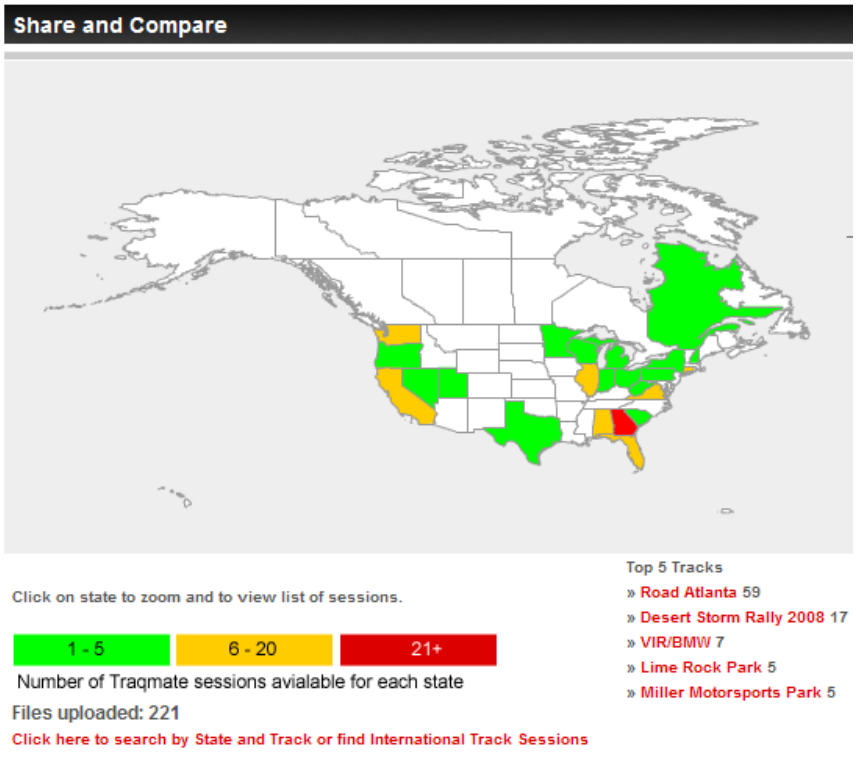
Share & Compare – Traqmate.com

Traqmate.com is your source for information, support, and upgrades. There you will find news, events, forums, tips, ideas, and new products to make your Traqmate the most valuable tool in your gear bag.

Exchanging Laps

If you register at the Traqmate website, http://www.traqmate.com, you are eligible to download other people's laps from around the world.

Laps are indexed by vehicle and track so you can easily find the laps you want. The files you download are .tqm files so you can open them with Traqview or use 'Add Driver' to add them to an existing analysis.


Share and Compare
Click on state to zoom and to view list of sessions.
1 - 5
6 - 20
21+
Number of Traqmate sessions avialable for each state
Files uploaded: 221
Click here to search by State and Track or find International Track Sessions
Top 5 Tracks
» Road Atlanta 59
» Desert Storm Rally 2008 17
» VIR/BMW 7
» Lime Rock Park 5
» Miller Motorsports Park 5

Play them back using Traqview. Overlay your own laps to create virtual races or do an analysis to learn other drivers' techniques.

You can also upload your best laps at a particular track so others can learn from you.

Appendices

Table of Figures

Figure 1 - Traqmate System Components 10
Figure 2 - Traqmate Basic Connections 13
Figure 3 - Traqmate Complete Connections 13
Figure 4 - Permanent Wiring Harness 16
Figure 5 - DU Gauge Cluster Mount 17
Figure 6 - DU Console Mount 17
Figure 7 - Sensor Unit Front and Rear Panel 18
Figure 8 - Display Unit Controls 19
Figure 9 - DU ChaseCam Status Icons 22
Figure 10 - Lap Timing 22
Figure 11 - Acquiring GPS Screen 23
Figure 12 - Recording a Start / Finish Location 23
Figure 13 - Searching for Start / Finish Line 23
Figure 14 - Lap / Qualifying Timer Screen 24
Figure 15 - Autocross/Rally Stage Screen 25
Figure 16 - Autocross/Rally Launch Screen 25
Figure 17 - Traqview Screen Layout 27
Figure 18 - Tool Bar Buttons 27
Figure 19 - General Traqview Options 29
Figure 20 - File Open Screen 30
Figure 21 - DIN - Serial Adapter Cable 32
Figure 22 - Traqmate Comm Settings 32
Figure 23 - Unit Info Screen 33
Figure 24 - User Data Screen 34
Figure 25 - IO Data Screen 35
Figure 26 - Session Upload Screen 37
Figure 27 - Dashboard 37
Figure 28 - Track Map, Graph and Form Setup 38
Figure 29 - Car Setup Screen 40
Figure 30 - Playback Controls 40
Figure 31 - Track Map 41
Figure 32 - Track Facts 42
Figure 33 - Car Facts 42
Figure 34 - G vs. Distance Graphs 43
Figure 35 - Velocity and Time Gap vs. Distance Graphs 44
Figure 36 - Horsepower and Torque Graph 45
Figure 37 - Elevation Graph 46
Figure 38 - Turn Radius Graph 46
Figure 39 - Friction Circle Graph 47
Figure 40 - Brake Zone Map 48
Figure 41 - Turn Zone Map 49
Figure 42 - Segment Analysis Table 50
Figure 43 - Segment Analysis Scoreboard 52
Figure 44 - Autocross / Rally Mode 53
Figure 45 - Gear by Distance Graph 55
Figure 46 - Setting Gears using Track Position 55
Figure 47 - Race Replay Mode 57
Figure 48 - TraqStudio – Actual Video Image 59
Figure 49 - TraqStudio Dash Displays 60
Figure 50 - TraqStudio Video Editing Screen 61
Figure 51 - TraqStudio Video Output Screen 63
Figure 52 - Tapping ECU Signal 64
Figure 53 - Connecting to Ignition Coil 64

Figure 54 - Digital Output Connections 67
Figure 55 - Connecting AIMsports Sensors 68
Figure 56 - Analog Sensor Connections 69
Figure 57 - TraqSync Connection to ChaseCam PDR100 70
Figure 58 - TraqData II Connection to ChaseCam PDR100 70
Figure 59 - TraqCam Cable to ChaseCam PDR100 71
Figure 60 - Enabling ChaseCam PDR100 Control 71
Figure 61 - Adding a Second Camera - ChaseCam PDR100 & SS1000 73
Figure 62 - Velocity vs. Distance Analysis 74
Figure 63 - Segments and Driving Line Analysis 75
Figure 64 - G vs. Distance Analysis 76
Figure 65 - Friction Circle Comparison 77
Figure 66 - Stacked Graphs 78
Figure 67 - Acceleration and Braking 79
Figure 68 - Skidpad Analysis 80
Figure 69 - Spin Diagnosis 81
Figure 70 - VIR Turn 14 82
Figure 71 - Road Atlanta Turn 1 82

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System Requirements

Traqmate Complete

300 MHz PC with at least 256Mbyte RAM
USB port
40 Mbyte disk space

Windows XP Home or Professional
Windows NT
Windows 2000
Windows Vista Home or Premium
Windows Vista-64

Traqmate Basic

300 MHz PC with at least 256Mbyte RAM
Serial port (or USB to serial adapter)
40 Mbyte disk space

Windows XP Home or Professional
Windows NT
Windows 2000
Windows Vista Home or Premium
Windows Vista-64

TraqStudio

800 MHz PC with at least 512Mbyte RAM
60 Mbyte disk space

Windows XP Home or Professional
Windows NT
Windows 2000
Windows Vista Home or Premium
Windows Vista-64

Warranty Information

Track Systems warrants to the owner of this Traqmate GPS Data Acquisition System that it is free from defects in materials and workmanship for a period of 180 days from the original date of consumer purchase. This warranty does not cover damage to the product as a result of misuse or accident, including but not limited to shock or water damage.

Remedies shall be limited to repair or replacement of the defective unit at Track Systems discretion. IN NO EVENT SHALL TRACK SYSTEMS BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. Some states do not allow for limitation of incidental or consequential damages, so this limitation may not apply to you.

If the product becomes defective while under warranty, or for service outside of warranty, call 1-877-289-0312 (9 AM to 5 PM EST M-F) to arrange for a Return Material Authorization and shipping instructions.

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Glossary

Accelerometer – A sensor that measures the G-forces on the vehicle

Analysis – The effort of examining recorded data for useful information or the results of such an examination

Analysis File – File with extension of ".tqs" that contains an analysis. May contain one or more sessions

AutoPan – A Traqview feature that causes the AutoPan Vehicle to remain in the Track window regardless of Zoom level

AutoPan Vehicle – The vehicle selected in Traqview menu to be followed during AutoPan

Data Acquisition – Measuring and recording of information

Display Unit – Lap Timer component of the Traqmate Complete System

DU – Display Unit

Firmware – Software that is embedded into the SU and DU that controls their operation

GPS – Global Positioning System, a satellite-based location method

Predictive Lap Timer – Display Unit timer that compares current lap progress with a stored reference lap

Reference Vehicle – In Traqview, first vehicle selected for map display

Segment – portion of the track that is being analyzed in Segment Analysis

Segment Separator – bent line on Track Map that separates segments

Sensor Unit – Silver box containing GPS receiver and accelerometers

Session – One group of continuous recording, typically a single trip or series of laps

Session File – File with extension of ".tqm" that contains one recorded session

Slider – Slide control at bottom of screen for positioning vehicle on track

Start/Finish Line – Place on track where a lap starts

SU – Sensor Unit

Theoretical Best Lap (TBL) – Best combinations of segment times from a session

TraqData – Analog, Digital and RPM input module

TraqData II – Analog, Digital and RPM input module with 4-wire ChaseCam interface

TraqPaq – Traqmate Battery Pack

TraqSync – RPM input module with 4-wire ChaseCam interface

TraqTach – RPM input module

Traqview – Windows data playback and analysis program

TraqStudio – Windows data and video playback and analysis program

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About GPS Data Acquisition

Several events converged recently to make GPS Data Acquisition viable. First, the US government removed the artificial errors in the GPS signal to improve accuracy. Second, the advent of high-speed single-chip GPS receivers made the technology both affordable and even more accurate. Third, the power of portable PCs increased to the point where they can process a large amount of mathematical and graphical data quickly. And finally, the popularity and increasing sophistication of racing and track enthusiasts created a market for the product.

The primary advantages of GPS Data Acquisition over more traditional sensor-based systems are:

Easy Installation – Using just the GPS positioning and accelerometers, you can collect an incredible amount of information, enough to compare drivers and cars. This makes the system accessible to street cars, vintage cars, and racecars that run in classes that do not permit sensor-based systems. It also makes it easy to swap the unit between vehicles. This is ideal for driving instructors and people with multiple vehicles. Of course, adding sensors is always an option if you wish to collect even more in-depth information.

Easy to Use – By starting with the track map and placing one or more vehicles on it, you have a visual reference for all the rest of the data that can be examined. This makes data analysis faster and much easier.

Driving Line Comparisons – By mapping each run, comparisons can be made of driving lines, braking points, and other track-dependent points.

Cost – There is no installation cost and no expensive sensors are required.

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GPS Frequently Asked Questions

What is GPS?
The Global Positioning System is a constellation of 24 satellites that orbit the earth twice a day, transmitting precise time and position (latitude, longitude and altitude) information. With a GPS receiver, users can determine their location anywhere on the Earth. The complete system consists of 24 satellites orbiting about 12,000 miles above the Earth, and five ground stations to monitor and manage the satellite constellation. These satellites provide 24-hour-a-day coverage for both two-and three- dimensional positioning anywhere on Earth.

Development of the $10 billion GPS satellite navigation system was begun in the 1970s by the US Department of Defense, which continues to manage the system, to provide continuous, worldwide positioning and navigation data to US military forces around the globe. However, GPS has an even broader civilian, commercial application. To meet these needs, GPS offers two levels of service, one for civilian access and the second encrypted for exclusive military use. The GPS signals are available to an unlimited number of users simultaneously, and there is no charge for using the GPS Satellites.

How Does GPS Work?
The basis of GPS technology is precise time and position information. Using atomic clocks and location data, each satellite continuously broadcasts the time and its position. A GPS receiver receives these signals, listening to three or more satellites at once, to determine the users position on earth.

How Accurate is GPS?
Traqmate is equipped with a form of differential GPS known as WAAS. A WAAS-capable receiver can give you a position accuracy of better than three meters (10 feet) in absolute terms over a large span of time. In product testing on racetracks, which typically have a good view of the sky, **recordings done close together in time were shown to be repeatable to under one meter accuracy**.

Under normal conditions, the GPS signal will provide a civilian user an accuracy of better than 15 meters (50 feet). However, using a technique called differential GPS (DGPS), the user can increase the overall accuracy of the GPS receiver to approximately 1-3 meters. With DGPS, one GPS receiver unit is placed in a known location and the position information from that receiver is used to calculate correction in the position data transmitted to other GPS receivers in the area. The resulting real-time accuracy is in the 10 foot range. Sub-meter accuracy can be obtained by using DGPS and post-processing calculations in static positioning.

WAAS stands for Wide Area Augmentation System, which is a system of satellites and ground stations that provide GPS signal corrections, giving you even better position accuracy. A WAAS-capable receiver can give you a position accuracy of better than three meters, 95 percent of the time. Currently, WAAS satellite coverage is only available in North America.

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